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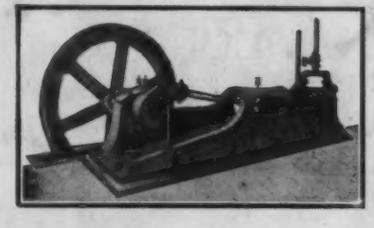

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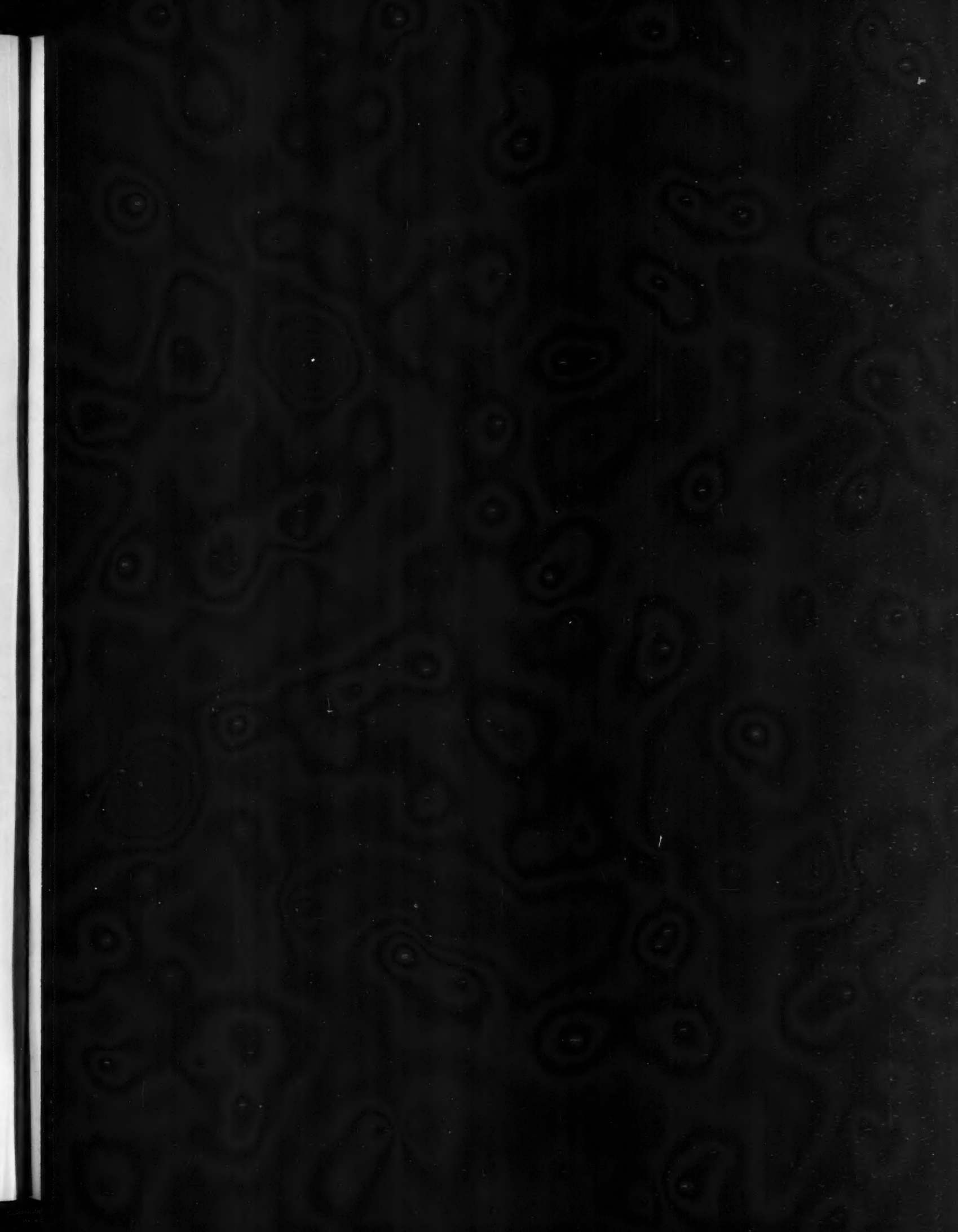

The Journal of Electricity, Power and Gas.

Devoted to the Conversion, Transmission and Distribution of Energy.

VOLUME XV. SAN FRANCISCO, CAL., SEPTEMBER, 1905. NUMBER 9

The Pacific Coast Engineering Congress.

Being an Installment of the Papers Presented Under the Auspices of the Lewis and Clark Exposition, Portland, Or., June 29-30, 1905.

PROBLEMS THAT CONFRONT ENGINEERING AND KINDRED INDUSTRIES ON THE PACIFIC COAST.*

BY GEORGE W. DICKIE.

The physical problems that have to be encountered by the engineer in his efforts to bring the vast territory known as the Pacific Coast into the best productive condition and to render it a desirable and comfortable place to live in, are peculiar to this side of the continent. The conformation of the face of the country, the character of the rock strata, the extreme condition of wetness in one locality and a similar condition of dryness in another locality, with a sparse population that limits the possible expenditure, are problems that our engineers have struggled with during the last fifty years and they will still be with us for the next fifty years to come. These problems can be safely left with the engineers now battling with them and to those who will follow them in the fields now occupied and in the new fields of enterprise that time and conditions are continually opening up. The problems I wish to bring before you at this time are not those of a physical character but are those that may be said to come within the department of economics. By engineering and kindred industries I mean all establishments whose business involves constructive engineering in all its branches, this includes all manufactures in metals, although not strictly engineering. In all this class of industrial products labor forms a large percentage of the total cost of production and, in order to reduce costs to the lowest possible point, manufacturing establishments must confine themselves to a certain line of output, perfect that line both in design and in method of production, having special tools for each stage in the process of manufacture. To make this possible a large market is necessary for each kind of product. These conditions so necessary to successful production of the numerous and varied mechanical devices required to carry on our modern civilization are not yet present on the Pacific Coast, gradually they will come with population, but we are yet very far from the conditions that will make industrial engineering an assured success amongst us. In many respects the general engineering establishment on the Pacific Coast was better off, as regards the certainty of business, thirty years ago than it is to-day. At that time the agent or representative of the manufacturer of machinery in the more densely populated parts of the country had not yet established himself on the Pacific Coast, and whatever machinery was required here for mines, saw mills, flour mills, steamboats, street railroads, etc., was built to order by some local engineering establishment on the best terms his customer could make with him and usually for some special type of machinery suited to the requirements of the case. Thus in some cases the best type of machinery for certain purposes originated on this coast and some notable examples of bold engineering were carried out successfully, that engineers in more settled communities would not have dared to undertake. Yet this very originality of engineering conception rendered the establishments that carried out such projects quite unfit to undertake the manufacture of machinery on economical lines. As soon, however, as the amount of machinery required on the Pacific Coast was sufficient in volume to attract the notice of manufacturers of special types of mechanism for various purposes, representative agencies were established in the centers nearest to where the bulk of such machinery was required, and the representative representing, as he usually does many manufacturing establishments, and being well furnished with plans, illustrations and specifications of the machinery he can furnish, is in a much better position to secure the general run of work of this character than the local establishment that has nothing that it manufactures to meet any general demand, but build some special machine to meet as far as they can the special needs of their customer, and herein lays the difference and the problem that the local establishment must solve or fail to reach permanent success.

The agent representing several large manufacturing establishments whose markets cover the needs of the whole country and who makes some special standard type of machinery well designed to meet the general requirements of those who need such machinery, has only to persuade his prospective customer that generally the machine he offers is the best adapted to the purpose in view and that it will be to his interests to modify any special condition in his case in order to use the standard type, and this reasoning promising, as it usually does, a saving in outlay, has a pretty good chance to succeed. While the local engineering establishment has but one chance and that is to persuade his prospective customer that the special conditions

*A paper read before the General Engineering section of the Pacific Coast Engineering Congress, held at the "American Inn" under the auspices of the Lewis and Clark Centennial Exposition, Portland, Or., June 29-30, 1905

of his case can not be ignored or changed without risking the success of his enterprise, that the machine that will entirely meet all his requirements successfully can not be secured from the stock of any manufacturing establishment, but must be specially designed to meet his special conditions, and though it costs considerably more, yet in the long run it will prove the best course for him to take. Now if the reasoning of the local engineer was always true, which of course it is not, for he tries to magnify the one condition as much as possible, there is still the fact that the prospective customer seldom gives proper value to the condition demanding special treatment, but takes the easiest course, the one requiring no study of conditions and examination into special plans, etc., but is inclined to accept the standard machine that can be delivered quickly and which he can actually see before he buys. Thus the local engineer is outdone by the local representative of a distant manufacturer, and the business that should support local establishments, increasing our wealth and population, goes away to enrich other communities. Here is a problem both for the engineer and the capitalist to find some solution for. The engineering business on the Pacific Coast does not suffer for lack of ability on the part of the managing engineers but rather because of too much brain.

If the Pacific Coast engineering establishment has to compete with an eastern establishment on an engineering proposition instead of a manufacturing proposition, even though freight and wages be heavily against the Pacific Coast engineer, his ability to handle new problems as they come to him will enable him to practically hold his own in the fight. This has been very forcibly illustrated in the building of naval vessels on the Pacific Coast. One concern has kept on building war ships at San Francisco and has evidently done as good work and with as good result in the way of profit as any of the eastern establishments with which they have been in competition. This goes far to prove that for work that is not simply repetition, the Pacific Coast engineer can and does hold his own against work of a similar character produced on the Atlantic Coast.

How then is he going to adapt himself and his establishment so as to keep that establishment going full power with a large part of his work, of that character that forms the standard work, turned out by the eastern manufacturing establishments. He can not hope to extend his market beyond the limits of the Pacific Coast, under the conditions in force here, and on that account can not manufact in the same sense that his eastern competitor does. He has some advantages however that count in his favor. The cost of maintaining agencies and commissions on selling the standard manufactured machinery is probably not less than twenty-five per cent. of the total cost and this should help the local engineering establishment, but as things are usually managed this advantage is not nearly enough for the local concern and may be entirely eliminated by the manufacturer whose market, extending over the whole country, gives him the chance to sell cheap at any place where the local establishment tries to sell the same class of machinery that he manufactures.

The prospect, in California especially, has brightened somewhat of late owing to the discovery of great subterranean stores of liquid fuel which generally means a saving of fifty per cent. in the fuel bills of an engineering establishment, besides it makes enterprises such as electric generation for lighting and power purposes possible that would not otherwise have been attempted, thus creating new fields for the engineering talent and the constructive ability of the country to work in. A good deal of this new field, that of the cheap generation of electricity, either through the burning of liquid fuel that comes from below or the falling of a purer liquid from the mountains is, I am sorry to say, not being cultivated by the local engineering works as it might be. I believe there is a splendid opportunity at the present time to establish somewhere on the Pacific Coast a great electrical establishment which would turn out complete electrical generating plants operated either by steam engines, water motors, or steam turbines. The field for this class of work on the Pacific Coast is a large one now and will grow steadily until it becomes one of our greatest industries. I have had some experience in the building of electrical generating plants on the Pacific Coast, the work being done in connection with a much larger output of general engineering work and under these conditions I found it quite possible to build at cost never greater than the selling price of similar work manufactured in eastern establishments as standard work. This leads me to believe that an establishment devoting its undivided attention to supplying the needs of the Pacific Coast in electrical engineering could build up a splendid and profitable business, combining well designed generators and equally well designed engines or water wheels, and taking in also all the engineering accessories that form part of any completed electrical generating plant. The principal factor in such an enterprise would be the cost of labor. As this item will be between fifty per cent. and sixty per cent. of the total cost of production its regulation will always be of the utmost importance. The rate of wages by the present system of compensating labor will, I think, be always higher on the Pacific Coast than it is elsewhere, perhaps no other reason can be given for this condition than that it is so and is likely to be so indefinitely, but while the rate of wages is higher here I do not think that the amount of wages paid for a given result need or should be higher here than it is elsewhere. I have for some years back been advocating a system of compensation for the labor in such establishments whereby the men as a whole who are to do the work should contract with the owners of the establishment in which they work for the whole labor involved in producing a certain industrial result, this would enable the workmen to decide whether they could afford to do the labor part involved in producing certain kinds of machinery for such an amount as would make it possible for the establishment in which they work to undertake the production

of such machinery. There are four factors that go to make up all estimates of cost in the class of industrial products we are now considering, these are:

"First." The prime cost of all the materials required for the proposed work to be done.

"Second." The actual cost of all labor necessary to convert the materials into the finished result ready for delivery to, or acceptance by, the customer for whom the work is done.

"Third." The proportion of the general expense account chargeable on such estimate.

"Fourth." Profit.

No work can be properly entered into by any industrial establishment, either as a contract or as something to be manufactured and sold as a finished product, without a careful estimate being made of all the items forming these four factors in the completed cost.

The estimator, if his work is to be a safe guide for the firm or company that he represents, must have correct information as to the amount of and the cost of all materials to be used in carrying out any proposed contract or the manufacture of any product for the market, this item is within the capacity of a competent man to have correct, so there need be no doubt about the first factor in the completed cost. The third item in the cost is the difference between the net and overhead costs, providing for the proper share of the general expense account. There is some difference of opinion amongst those who manage engineering establishments as to what should form general expense, I have always held that all charges of every nature that can not be charged direct to the individual job should be charged to this account. This would include the cost of general management, all foremen in charge of more than one job, all handling of material until it is charged to some particular work, all fuel and water bills, the whole office force except draughtsmen that are charged direct to the job they are working on, taxes, traveling and advertising expenses, repairs, and depreciation. If for instance an estimate were being made, the approximate amount of which was $1,000,000 and the total amount of work done the previous year was $5,000,000 and the general expense account including all items not chargeable direct to a specific job for the year was $500,000 then the item for general expense in an estimate amounting to $1,000,000 would be $100,000 there is no reason why this important factor in the estimate should not be correct, and to keep it as low as possible and still be correct, has an important bearing on the success of the business in question, the larger the output in proportion to the general expense the less the prime cost of the article produced.

The second item in the cost, the actual cost of all labor necessary to convert the material into the finished result, ready for delivery to or acceptance by the customer for whom the work is done, is the uncertain factor that brings the element of speculation into the estimate, and while it forms the largest single item of the estimate, the estimator can only approximate its cost from past experience, what the ultimate cost of the labor will be depends largely upon the relationship between his company and the men who are to do the work.

The variations in the cost of labor on the same amount of work done at different times, resulting from different men and different conditions, is often sufficient to wipe out several times over the estimated profit on a contract, and I have often thought that if it were possible to make the labor item in our estimate a sure thing it would bring new life and vigor into engineering industries over the Pacific Coast. There is a certain amount available for the compensation of labor in the estimated cost of the product in any industry, and that amount can not be exceeded under a given condition of market. If the fourth item, that of profit, were ten per cent., an addition of twenty per cent. to the labor item would completely wipe out profit. This variation of twenty per cent. in the cost of the labor item is not an unusual occurrence under the present system of compensation for labor.

In estimates involving many trades and large numbers of men, even under ordinary peaceful conditions, large allowances must be made for incompetent men and unwilling hands that wait for time to move on to pay day and who have no interest in what has been produced for the pay they receive. My experience has lead me to the conclusion that a desire to do the very best they could by all hands every day would, in engineering establishments that pay their men for the time they are at work, practically double the labor result. How can this desire to work be excited in the workman? I have carefully studied several methods in use to encourage this desire to work, at industrial establishments both in this country and in Europe, having for their object the compensation of the workmen in accordance with the work produced without the objectionable feature of piece work. Piece work and most of the premium plans deal with the product of the individual man and besides raising comparisons between the men themselves which are odious here as elsewhere, can only be applied to such parts of the work that can be readily separated from the general work being done and in large establishments covers only a small portion of the work. My experience, combined with a careful study of this subject has forced me to the conclusion that the only way to get the best result out of all the men employed in a large industrial establishment, is to combine them all by mutual interest in bringing about the best possible industrial result, and into that combination the employer must also bring his interests. The working man must first be made to understand that the establishment in which he works must be run at a profit or it will soon cease to run at all. The possible profit is a difficult thing to get the men to understand, many workmen gathering their information from the wild statements made by labor leaders and a certain class of newspapers, have very exaggerated notions of the profits made in engineering industries. I had occasion some time ago to speak to a number of workmen bent on forcing very hard conditions on their

employers, and the question of profits was brought up during the discussion showing that their ideas of what it was possible for their employer to do and yet have something left, were quite remarkable, nor could any impression be made upon them by the statement that in eighteen years their employers had paid out in wages $28,000,000 and during the same time the stockholders had been paid $1,300,000 in profits, or less than five per cent. of the wages paid. This would have given each workman one and one-half cents more wages per hour and the stockholders nothing, yet these same men if they had all worked their best might have readily doubled the result and thereby increased materially both pay and profit.

In the attempt to solve the problems involved in labor costs on the Pacific Coast, the main thing that both the employer and the employed must accept as the foundation for any scheme that is to permanently bring about proper and natural relations between them and to give hope in regard to our industries, is justice, without that nothing can be done. The one side must have perfect confidence in the justice of the other. If this attitude can be assumed and maintained all other difficulties can be overcome. Most of my thinking, combined with some action on this problem, has been in connection with engineering industries, and I would like to state to you, as far as I can in words, how I would propose to solve the problems in the cost of labor. I have stated that in all estimates labor is or should be treated as an independent factor, and it is the most difficult of all the factors entering into an estimate to determine. What it should be to meet the market value of the work produced, is within the power of the experienced estimator to decide; but what it will be depends entirely on how the men that are to do it feel about it. I have found out a curious fact about this question of labor values: That all the intelligent workmen, whom I consult with about it, set a much lower value on the labor required to produce a given result than my experience tells me is necessary. They instinctively think of what a man could do if he tried, while I have been forced to figure on what he generally does, and thus, what under ordinary circumstances an unwilling man can be persuaded to do, has become the measure of the value of labor in the estimates that are regularly made in engineering works where the men are paid for time instead of for work. In engineering estimates the labor item will be from forty per cent. to sixty per cent. of the total amount. Very few workmen believe this, in fact I have generally found them under the impression that the profit was from forty per cent. to sixty per cent. An average proportion for general machinery estimates would be: Labor, forty per cent.; material, forty per cent.; general expenses, twelve per cent.; possible profit, eight per cent. With this proportion, which may be taken as roughly correct, an increase of twenty per cent. in the cost of labor would completely wipe out the item of profit.

Suppose then that our engineering establishment agreed with all the men employed in the works, that the amount set aside for labor in any estimate should be accepted by the men employed as a whole, as the compensation they should receive for performing all the labor required to complete the work represented by that estimate. All the men employed in that case, would have to be represented by a committee of themselves, say one from each department of the works, who would go over the estimate of labor with the representative of the works who made the estimate, and accept if satisfactory on behalf of the men they represent, this might be done before the tendering for the work so that the workmen themselves would be tendering for the labor part of the proposed contract. The question might be raised here as to the ability of those representing the men to determine as to the correctness of any estimate for labor, that the employer has all the skill and experience necessary to make his estimate of labor, while the representatives of the men do not, as a rule, possess this skill and the men would therefore be at the mercy of the employer. There need be no fear of this difficulty, as the men are not likely to appoint representatives who are not thoroughly competent to watch their interests, in fact as already stated, the men are apt to place a lower estimate on the value of labor than the employer. The employer, as at present, would ultimately have to stand the chance of possible loss, but that chance would be very much less than it is at present, as the possible gain by the workmen would be an incentive to every one to do his best.

Under such a management I would propose to engage all the men just as they are employed under the present system, the foremen rating every man at what he considered him worth per day, or to meet the altruistic ideas now prevailing among the trades union men, a uniform rate could be decided upon for all the tradesmen, rates also would be fixed for apprentices learning trades, and rates for laborers. Each man's or boy's rating would be posted up in the department in which he works, and his fellow workmen, through their committee, should have the right to have this rate reduced if they found that the work he turned out was not equal to his rating. All wages would be paid as at present, according to the rating. The full amount for which the men had contracted to do the whole labor on any job for would be placed to the credit of labor on that job, and the wages paid out on that job would be charged against that account. As each job or contract was finished the unexpended amount on that particular job or contract, if any, would then be credited to the labor surplus account. If on any job or contract the wages paid should be more than the amount accepted for labor the difference would be charged to the labor surplus account. At the end of each year the amount that had accumulated in the labor surplus account would be available as a dividend on labor, and whatever percentage it formed of the total amount paid for labor during the year would be the per cent. each man would receive on the amount he had earned during the year.

This enables each workman to participate in the profit of the labor part on all work done in the establishment, whether he was a long time or a short time employed during the year, and without any reference to the particular job he may have worked on; so that no matter what he may be doing or in what capacity he works, how he does that work will either swell or diminish the general dividend, and every man will see to it that his fellow workman does not reduce his dividend if any instruction on his part will prevent it.

I believe the time has come when the item of labor must be dealt with differently from the present methods, it can not be considered as an article that can be bought by any time measuring arrangement, the time has come when it can be contracted with, its hopes must be taken into account, it must have something to strive for or it will not strive at all. I believe that the difference in result between the work of earnest workmen trying to do the best they can and whose recompense is measured by what they accomplish and the indifferent labor that is forced out of a man by constant watching and urging during a certain number of hours, is so great that it would practically compensate for the difference between the cost of production in the manufacturing establishments of the Atlantic Coast and the cost of production under existing conditions on the Pacific Coast. I fully understand that such a system of compensation to workmen, as I have outlined, presents difficulties of a special character in every kind of business. I have studied it very carefully in its application to an engineering business and have reached the conclusion that some such plan as I propose will be ultimately accepted by both employer and employed, as the only solution of the labor problem as it effects industrial engineering. Courage and honesty combined with the right kind of skill on the part of those managing such concerns would, if patiently applied, result in such benefits to workmen and to those with whom they work, as would save many an industry on this coast which, under the present unjust methods of dealing with labor problems, has nothing before it but impending ruin. I have dwelt thus long on the labor problem as it affects the possibility of constructing here on this coast the great bulk of the machinery required in the development of our resources, because it is after all the great and only hard problem that confronts us. Give labor the place that its importance demands in the councils of men. It is forty per cent. of the problem of operating successfully any engineering establishment and should have its say in regard to that forty per cent. if admitted to council in regard to that forty per cent. Labor unions would soon lose themselves in labor associations represented by directors of their own choosing, who would be a forty per cent. factor in every estimate that was made and who would be able to give and take with the other sixty per cent. in order to meet the conditions of market values. If the manager of an engineering establishment could meet the representatives of the workmen when making up his estimate for work to be done, and settle with them the cost of the labor part of the estimate, just as he meets the steel manufacturer and settles with him the cost of the part that he is to furnish, then mutual concessions that might be necessary in order to prevent the work from going elsewhere, could be made without the feeling that either party was trying to get an advantage over the other.

Our universities are training large numbers of young men in the various branches of engineering and out of our common schools are flocking thousands of youths eager to find places in the mechanical crafts, probably oue hundred for each one that can get a chance, because one commission agent can sell as much finished work as will keep 500 hands at work in some far off establishment, while a corresponding number of hands are idle here. The Pacific Coast will make slow progress in the mechanical arts until conditions are such as will enable us to do much more of our own work than we are now doing. What is usually termed "business management" is also a factor in the success of an engineering industrial enterprise. The ability to make something well and economically must be combined with the ability to sell it to the best advantage and in the nearest market, these two qualities are not often found in the same individual in their highest development. Still a good engineer should also be a good business man. Both of these faculties need common sense and the habit of thinking clearly backed by an educated judgment. Of these two requisites however, the engineering business is most dependent upon the ability to make the proper thing for the work in hand at a price that will enable it to enter the market and compete successfully. In other industries the business faculty is the dominating factor in success. In some industries the cost of manufacture is but a small percentage of the cost of the finished product, in such cases business management in buying the raw material at the one end and in selling the finished product at the other end of the completed transaction, is of vital importance. Take the sugar refining industry that may be said to have succeeded on the Pacific Coast. The cost of refining sugar in a first-class modern refinery is less than one-eighth of a cent per pound, while the fluctuations in the price of raw sugar and of the refined product may be many times the total cost of refining in the course of a year or two. In such cases success depends chiefly on the business management, but in the engineering industries the purchased raw material does not cost more than about forty per cent. of the value of the finished product, hence the importance of shop economy where the other sixty per cent is expended.

The problem for the engineer to solve being, how can I on the Pacific Coast, with all the elements that go to make up that sixty per cent. costing more than anywhere else, bring about a final result such as will enable me to sell my product at a price that will not be greater than the product of another establishment so situated that the elements that go to make their sixty per cent. cost less than they do here? And yet it is just such industries, the problems

connected with which are so hard to settle, that are of most importance in the development and building up of the Pacific Coast. The volume of business done is not always a true measure of the prosperity of a State. The kind of business done is often of more importance than the amount. An agent selling $100,000 worth of machinery on the Pacific Coast and receiving ten per cent. commission, can only distribute $10,000 in the community out of the $100,000 spent. While if the same machinery had been made here $60,000 would have been distributed in the community out of the $100,000 spent, or comparing the business of sugar refining, already mentioned as having succeeded on the Pacific Coast, as compared with an engineering business which I will suppose to be also successful:

The refiner buys raw sugar to the extent of	$5,000,000.00
Cost of refining	187,500.00
Total cost of product ready for the market	$5,187,500.00
The refiner sells this product at	6,687,500.00
Refiner's profit	$1,500,000.00

The refiner may take his profit anywhere and spend it or he may reinvest it in the community and thus build up the State, but the immediate distribution that takes place is only the $187,500 or the employment of about 235 men.

The engineer buys raw material to the extent of	5,000,000.00
Expends in converting raw material into machinery	7,500,000.00
Total cost of product ready for the market	$12,500,000.00
The engineer sells this product at	13,500,000.00
Engineer's profit	$1,000,000.00

The engineer may, like the refiner, take his profit anywhere and spend it or he may invest it in the community and thus help to build up the State, but the immediate distribution that takes place is $7,500,000, or the employment of 9,375 men. This illustrates the difference between one kind of business and another as to their effect in building up a State, the unfortunate thing is that the business that produces the greatest difference in cost between the raw material and the finished product should be the most difficult to establish as a permanent enterprise on the Pacific Coast. If our labor costs could by any such plan as I have outlined, be made to approximate what they are on the Atlantic Coast, I believe that we could build here all the machinery, ships and other engineering products that the development of the Pacific Coast requires. We would thus soon acquire a population that would give impetus to every enterprise and start this whole great territory on the high road to such a development as is not now dreamed of by the most advanced optimist amongst us.

THE PRINCIPLES COVERING THE VALUATION FOR RATE FIXING PURPOSES OF WATER WORKS UNDER PRIVATE OWNERSHIP.*

BY ARTHUR L. ADAMS.

PURPOSE AND SCOPE OF PAPER.

The constantly increasing interest among the thinking people of this country in the evolution of some process by which so-called "public service corporations" may be brought under such government control of rates charged by them as will secure protection to the public against unfair discrimination, insure the making of no greater average charges for the service rendered than such service is reasonably worth, and at the same time will afford such properties immunity from spoilation under the guise of lawful regulation, is justification for the careful consideration of any important aspect of this very difficult problem.

That many of the questions involved are of a character calling for solution by those familiar with works construction and management, and that the aid of such men is frequently sought to assist the courts in reaching right conclusions in cases arising under existing laws, fully warrants in the opinion of the writer this presentation.

Legislation on the subject may as yet be regarded as in an experimental stage; and the resulting accumulation of experience has demonstrated the unwisdom of many of the methods employed in attempts to establish such control.

The whole subject needs most careful consideration by those whose training best fits them to devise methods with a clear vision as to their practical consequences.

The regulation of rates by governmental agency, whether such regulation takes the form of the fixing of rates outright, or the revision of rates made by the corporation, presupposes the right of the corporation to receive a fair and just return upon the value of its property.

The ascertainment of what constitutes the fair and equitable value of such properties is always the important initial step. It gives rise to most interesting and complex questions involving the consideration of ways, means and cost of construction; of the subsequent practical conduct of such works as to their operation, maintenance, growth, and financial management, and the value to the public of the service rendered. It also calls for the exercise of the judicial temper, a keen sense of justice and fair dealing, and often no small measure of imperviousness to public criticism.

The first before mentioned requirements are certainly such as must be possessed by any successful engineer of high professional standing; and impartiality, dicriminating judgment, and equanimity under trying conditions should certainly characterize the members of a profession so often called upon to decide between contending interests.

It is, therefore, the writer's belief that our profession will fail of its privileges and its duty if it does not in-

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fluence in a very large degree the final formulation of wise legislation on this subject, and sound court interpretations.

The principles governing the determination of value of all such properties are quite similar; and though this paper deals with but one class, as its title indicates, the writer hopes it may prove of interest to specialists in other lines.

No effort will be made to treat the subject of appraisement, even of water works in all its aspects, but rather to assume conditions likely to prevail in bringing most public service corporations under governmental control or supervision as to rates.

By the adoption of certain premises it is intended that all exceptional cases arising from special contracts, special legislation, or otherwise, shall be turned aside, and the question become a general one as to what under the more ordinary circumstances constitutes the just and reasonable value of water works properties of private corporations devoted to and being used for the public convenience. And, even when thus restricted, the limitations of space will confine the writer to the discussion of the leading principles and factors only.

It is, therefore, presupposed:

First—That works are built under legal authority, imposing no restraints affecting their value.

Second—That the value of the property is sought as the basis for the fixing of such rates by governmental authority as shall return to the owners a fair and just compensation for the service which is rendered.

FUNDAMENTAL FACTORS INFLUENCING VALUE.

The question of what constitutes reasonable and just value under the above conditions ordinarily necessitates the consideration of the following questions:

(1) Is the plant of such character as to enable it to properly fulfill the obligations which it has assumed of supplying the public with a suitable water service, both present and future?

(2) What has been the cost of the works?

(3) Has its acquisition been characterized by the exercise of a reasonable degree of prudence and engineering skill?

(4) Has the policy of the rate-fixing authorities been such as to make necessary any special financial policy in the conduct or acquisition of the water works properties, with special reference:

First—To the refunding of capital invested in structures of perishable character, or having a usefulness limited as to time.

Second—To the allowing of interest returns upon the properties acquired for future use of an increasing population.

(5) Would a reduplication of the existing structural works cost less or more than the present structural works have cost?

(6) Would the construction of substitutional works cost less or more than the present works have cost?

(7) Have the real estate and water-producing properties of the company increased in value?

(8) Has the franchise any value?

(9) Does any special value attach to the fact that the company has an established business capable of producing an adequate revenue?

(10) Does the value of the service rendered to the consumers limit the value of the property?

No single formula can be made sufficient for the determination of value in all cases. Each of the above enumerated factors, and possibly others may, under certain circumstances, properly exercise an influence in determining the final result. The degree of weight which attaches to each may vary greatly with circumstances. No final conclusion can be intelligently reached until all have been considered and their relative importance weighed, often one against the other.

Value is, therefore, not a quantity which can be determined with any mathematical accuracy. Its limitations as to maximum and minimum can usually be fairly well defined. When circumstances require the naming of a specific figure, it can only be reached by the final, possibly arbitrary, exercise of personal discretion after reasoning processes have so far as possible, narrowed the field of its final employment.

The application of the result, however, in determining rates is of itself subject to no absolutely defined rule, and admits of a considerable range of use without doing violence to natural standards of fairness and equity.

That value, therefore, cannot be determined with mathematical nicety does not detract from the usefulness of a conclusion, though it be in a sense approximate only.

The before enumerated fundamental queries will now be taken up in their order for the purpose of showing their relation to reasonable value and, to some extent, the manner of their application. These factors are so closely inter-related that it requires careful analysis to make clear their bearings the one toward the other, and the limitations which each impose upon the result sought.

THE FITNESS OF THE PLANT TO FULFILL THE OBLIGATION WHICH THE COMPANY HAS ASSUMED OF SUPPLYING THE PUBLIC WITH A SUITABLE WATER SERVICE, BOTH PRESENT AND FUTURE.

The relations between the public and the water company are of a mutual character. If the public owe the company a sufficient revenue to operate and maintain its plant and pay to its owners a reasonable return upon its value, no less does the company owe to the public an abundant and uninterrupted supply of good, potable water. It owes the exercise of such energy, prudence, skill, economy and capital as will successfully anticipate contingencies of accident or increased demand, and such as will at all times enable it to supply water at the least cost to the consumer consistent with justice to its stockholders.

Fair treatment and a fair valuation on one side presupposes the maintenance of an efficient and economical service on the other, and the vice versa is equally true. It

is, therefore, proper that inquiry be made into the character of the plant used and intended for supplying water. Such an inquiry, particularly in regions of lesser rainfall, naturally fall into the following order:

(1) The water supply as already developed as to quantity and quality.

(2) The adequacy and suitability of the provision for future increase.

(3) The present consumption and possible future demand.

(4) The suitability of the works for conveyance and distribution.

The scope and character of the investigations necessary to develop the desired information embraced under these various heads will, of course, differ greatly in different cases. With but one exception, they call for no comment here. The appropriateness of each subject in determining value would seem to be beyond question. The second has, however, been called in question, and claims attention. It has been contended often, and even so held by certain courts, that in determining value, only properties actually employed for the delivery of water, or maintenance of the service at the time in question, should be included. In view of this sentiment it is well, therefore, to remember that the duty of a water company to maintain an efficient service implies and imposes the responsibility for anticipating the future increase of consumption, that the available supply may never for one moment fall below the proper and legitimate demand.

This responsibility in the supplying of a city means the forecasting, often for many years, of the probable population and per capita consumption.

It often means the necessity for the acquisition of necessary lands, water rights, and storage reservoirs years in advance of their actual use for the delivery of water, lest when imperatively needed they be impossible of acquirement or are purchasable only at a prohibitive price.

The building of structures of the magnitude often required is, in itself, not infrequently a work of several years.

It therefore follows that at all times the water company must know in advance just where and in what quantities its future water supplies are to be secured.

The relation of such acquisition to present value will more appropriately be taken up under a later head.

THE COST OF THE WORKS AND ITS RELATION TO VALUE.

Cost alone is seldom determinative of the value of any enterprise. Such value may be very materially influenced by the worth of the business; that is, the amount of its earning capacity, present and prospective, or by the probable cost of building a new plant of equal or better efficiency, or by other considerations.

But in the case of a system of water works devoted to public use at a rate of compensation fixed, not by its owners, but by governmental agency, and so fixed as to yield as a net return a moderate rate of interest only on the value of the property employed, the reasonable actual cost of such properties to their owners would seem to represent in almost all cases the lowest value upon which a rate schedule can, with any claim to equity, be based; and, though said cost may be by no means determinative of full value, it may be regarded as the most important factor involved and the one usually determinative of the minimum of value.

Reasons for this view are simple, direct and conclusive because founded on the practical necessities of water works construction, operation and financial management. They may be enumerated as follows:

First—The purveying of water in a modern city is a necessity upon which the welfare and very existence of the community depends. This service must, therefore, for the public good, be performed by either private or public initiative, regardless of how great may be the necessary cost.

Second—When rates are so fixed as to cover only the expense of maintaining the plant in a serviceable condition, and pay a current rate of interest on the value of the property, such a policy precludes the company's making any financial provision for safeguarding its investments against depreciation by subsequent reductions in the market price of materials and labor, or otherwise.

Third—Water works properties of magnitude are never created at one time. They are the product of years of growth, being increased and extended a little at a time, from year to year, in compliance with the demands of the community growth. In many Western States water service must largely precede instead of follow population, while the supply must always be maintained in quantity well in advance of present demand.

Fourth—The imagining of a system created as of one time at current prices of lands, materials, and labor, is wholly fanciful and has never supplied a large city with water, though such an assumption, as we shall see, at times has its use.

Fifth—The final test of accuracy in every estimate is the actual cost of the completed work, built as such works are of necessity actually built. Actual cost of the completed work must, therefore, be entitled to far greater weight in determining their value than any mere estimate resulting from the unavoidable assumption of impossible or unnatural conditions, and the use of assumptions in lieu of the results of accomplished fact.

Sixth—Materials and labor once purchased and used as a part of a system of water works are no longer commodities in the market with value fixed by the rise and fall in prices of new materials and labor. At a certain cost these things have already entered into the creation of a system and are devoted to a fixed and permanent use; and why should one adopt as a starting point in the determination of structural values a standard subject to daily and almost unaccountable market variations in preference to a standard that actual accomplishment has unalterably fixed. There appears no good reason for so doing, so long as the statements of actual cost are worthy of credence and their reasonableness unimpeached.

If, on the other hand, the rate-fixing powers have made such liberal provision in the revenue as to permit in addition to adequate returns upon the property value the making of ample provision for safeguarding the property against loss through falling prices of materials and labor, or the deterioration of perishable materials, or the abandonments incident to changing conditions, as well as other possible causes of loss, then cost becomes of lesser importance in determining a just value of all structural works, and corresponding greater weight may attach to estimated cost of works, of duplication or substitutional equivalent without working injustice.

In determining the actual cost to a company of its plant, recourse can usually be had to its book record. The reliability of such record can, by a competent engineer, generally be determined by a study of the property. Not with exactness, of course, but within such reasonable limits as is worth while attempting in arriving at a final determination of present value, involving, as it does, so many broad considerations.

An important question, however, relates to the disposition of losses early in the history of the plant, arising from the lack of revenue and their relation to cost and value.

The correctness of the policy of adding annual deficiencies in the operating of a plant to investment in determining the cost of a property to its stockholders, as contrasted with other forms of investment paying current rates of interest is, of course, admissible. That such a course throws any light upon the question of value of the property is not so clear, and needs amplification.

In ordinary competitive enterprises, such a computation would indicate nothing more than the loss which had been sustained in comparison with more remunerative forms of investment. If, however, as in the case of almost all water works, the enterprise be of a character which does not usually and, therefore, is not expected to yield adequate returns for some years after its inception, making the anticipation of this condition necessary to the successful financing of the enterprise, and its establishment on a firm basis, such early losses may be charged to investment and become a measure of the money value of that intangible, though none the less real, asset known as "established business" or quality of being a "going concern", or possessing the ability to earn an adequate revenue, which the courts have recognized in certain important cases.

With a meritorious enterprise there should, of course, come a time in a reasonable period when the earnings become sufficient to pay a proper return upon the investment, inclusive of such early losses, otherwise it must be classified as unprofitable, and its value be less than its cost.

In the case of a public utility, limited as to its possible earnings by an extraneous rate-fixing body unnecessarily to a sum less than sufficient to constitute a proper return upon the investment, it would appear that redress from this condition should be sought in the courts rather than by charging such losses to investment for a long period of years.

Save in so far, therefore, as these losses may be said to be a measure of the cost of establishing the business, they do not of themselves, unsupported by other considerations, constitute a basis of value; and the most that can be claimed for them on their own account is that such losses from lack of revenue during the early history, constitute the cost of and are, therefore, a measure of the value of that asset known as "established business."

Losses from abandoned structures from lack of sufficient revenue for refunding the money thus invested, must be regarded as in much the same position as losses from inadequate interest returns from the same cause.

Such losses will, however, seldom accrue to the cost of establishing the business, for this should ordinarily be accomplished within the life of all structures of importance.

It is true that failure on the part of rate-fixing powers to afford this revenue, when it could reasonably be allowed without imposing excessive rates, does a gross injustice to a water company, which should not be tolerated, but if such structures are permitted to long pass out of use without enforcing compensation for them, they cannot be said to still have value save possibly as a moral claim.

THE DEGREE OF PRUDENCE AND ENGINEERING SKILL EXERCISED IN THE ACQUISITION OF THE WATER WORKS PROPERTY AND THEIR RELATION TO VALUE.

In considering this subject it is necessary to ascertain:

First—Whether no greater price has been paid for land and water rights than was reasonably necessary.

Second—Whether the structural works have been designed and built on sound engineering lines and with a proper regard for wise economy.

The first calls for no special comment.

In passing on the second it must be remembered that no small part in engineering is the adapting of means to ends, that there are almost no established standards of design, that no two men will ever plan works along identical lines, and that a wide range of liberty of choice must be accorded the engineer.

The appraiser has a right to expect and demand that the works shall have proven reasonably successful considering all the conditions which have influenced or controlled their design and construction, with average practice as his standard rather than his own personal preference. Beyond this he should be sparing of criticism. Unqualified failures due to inexcusable ignorance or bad judgment must lead to rejection in determining value, but the appraiser will often find difficulty in determining in his own mind where to draw the line between what is excusable and what inexcusable. If he is a man of wide experience he is least likely to indulge in hasty or harsh condemnations, realizing that engineering is very far from being an exact science; that to some extent it will always be the unexpected that happens; that defects are more

easily discoverable under the test of actual trial; and that criticism is far easier than creation.

THE PAST POLICY OF THE RATE FIXING AUTHORITIES IN MAKING PROVISION FOR THE REFUNDING OF CAPITAL INVESTED IN STRUCTURES OF PERISHABLE CHARACTER OR HAVING A USEFULNESS LIMITED AS TO TIME; AND IN THE ALLOWING OF INTEREST RETURNS ON PROPERTY ACQUIRED FOR THE FUTURE USE OF AN INCREASING POPULATION, AND THE RELATION OF SUCH POLICIES TO EQUITABLE VALUE.

Depreciation as ordinarily applied to water-works results either from the wear and tear incident to use and exposure to the elements, or from enforced abandonment on the score of economy or of changed conditions.

For example of the first, iron pipes are gradually rendered useless by corrosion until renewal becomes necessary; for example of the second, pumping stations may have to be abandoned because the water supply has become of uncertain purity, or because increased consumption or later and better designed machinery renders the old unsatisfactory on the score of economy, even though such machinery may still be in as good condition as it ever was.

In any event depreciation represents a shrinkage or diminution of tangible property value which must be written off to expense as a part of the cost of maintaining the service and which must be paid for out of the revenues if the capital so invested is to be preserved unimpaired.

There are two ways by which this may be done.

First—By the establishment of a fund out of which all renewals and losses from abandonments are made good, the said fund being maintained by uniform periodical contributions from the revenues; or

Second—By meeting the actual expense of renewals and abandonments each year out of the revenues of the same or succeeding year.

Either policy preserves intact the invested capital and charges depreciation where it belongs as an item of expense.

The former method is for some reasons to be preferred, chiefly because it equalizes this item one year with another, thus permitting a more uniform water rate, and because it is the practice almost always followed though in an indirect way. For most water works unless prevented by restrictive legislation make provision in their revenues each year for the redemption of a portion of their bonded indebtedness, and under all ordinary conditions such provision exceeds in amount and renders unnecessary the making of any other provision for depreciation.

It scarcely need be pointed out that a policy of making no allowance at all or of making insufficient allowance for depreciation, and then discarding the cost of the structures after abandonment in the determination of value for rate fixing purposes, is nothing else than confiscation, which by a process of gradual absorption tends to ultimately consume all the capital invested in such structures, with the result of having afforded water service to the consumers at just that much less than cost to the company.

The power that fixes the revenue determines the method by which depreciation shall be cared for, if cared for at all. If that power has made possible the provision of no fund for this purpose, but has on the other hand established the policy of allowing depreciation only as the renewals are actually made, the policy should be pursued to its logical and right conclusion and no structures when abandoned be disallowed in whole or in part in determining value until its cost shall have been in the same proportion refunded from the revenue.

Structures which have passed out of existence or which no longer serve a useful purpose may not be included whether the matter of their depreciation has in the past been rightly or wrongly dealt with.

Structures which are still useful should not be depreciated in determining value without provision being made in the revenues for refunding their cost.

When a charge is properly made against the otherwise value of a property because of structural depreciation, the amount of that charge should not be greater than the estimated present value of an interest bearing sinking fund which contributed to annually during the average useful existence of the plant will equal in amount the investment in the various parts at the end of their usefulness.

If it is the duty of a water company to use reasonable diligence to secure for the future as well as for the present an abundant water supply, a proposition seemingly beyond question, and if this can be accomplished most prudently by the acquisition of properties in advance of their actual requirements for the supplying of water, it certainly seems that such property before its development is in the true sense in use, since it has been purchased for and devoted to that purpose in recognition of the company's duty to the public.

If it has been the settled policy to include such properties, then the investor, being relieved from risk and loss of interest in such investments, might in fairness well feel that the public had acquired such rights as would warrant his accepting a lower interest return, or its equivalent, on the value of such property after it finally comes into actual use than otherwise. In other words, actual cost would then have greater weight in determining value for rate-fixing purposes than the cost of an equivalent property.

If, on the other hand, it has been the established policy to exclude all property not actually employed for the supplying of water in determining value for rate-fixing purposes, thus compelling the water company in the discharge of its duty to carry such properties, it may be for years, at its own risk, then surely this original cost has much less weight in determining their value when they do come into actual use—unless, indeed, cost be

made to include also the losses of interest due to their retention—and the cost of other equivalent properties become of correspondingly greater importance in determining value.

It therefore logically appears that lands and water rights in general which, of necessity, are in the main secured and held long periods in advance of their actual use, should, in the determination of their values, after they have been brought into use, have considered their cost inclusive of loss of interest, and also the cost of acquiring a substitutional equivalent. The latter should establish the maximum and the former the minimum when below the latter, provided that the total valuation of the entire water works property does not exceed the value of the service rendered. Should cost, with interest, prove greater than a substitutional equivalent, it demonstrates imprudence for which the consumer should not be held responsible.

THE ESTIMATED COST OF THE REDUPLICATION OF THE EXISTING STRUCTURAL WORKS AND ITS RELATION TO COST AND VALUE OF EXISTING PLANT.

Previously herein has been pointed out the grave objections to adopting the theory suggested by this heading as the sole or even paramount consideration in the determination of value of existing structures when they are sought to be valued simply as structures separately and independent of their relation to the system as a whole.

Nevertheless, it is proper to make such inquiry even though the actual cost of the existing structures may be known with certainty, for the answers will usually be serviceable in determining the degree of prudence and economic skill which has been exercised in the construction of the existing works. In other words, the answer to the query goes rather to the question of prudence in the expenditures actually made than to the value of the structural works in question. This is particularly true where the rate-fixing authorities have pursued the policy of not allowing a revenue sufficient for safeguarding the actual investment in structures against subsequent falling prices and corresponding lesser cost of their reduplication at a later date.

Works of the magnitude here considered never are and cannot be constructed as of any particular date or any particular year. In determining, therefore, the probable cost of their reduplication, it is necessary to forecast the prices of materials and labor likely to prevail at least during such period of time as would be necessary to carry out the assumed program. To make such forecast one cannot usually do better than to judge the future by the past, and assume as a basis the general average of conditions which have prevailed for a period of years.

THE ESTIMATED COST OF THE CONSTRUCTION OF SUBCONSTITUTIONAL WORKS, AND ITS RELATION TO VALUE OF THE EXISTING PLANT.

The estimated cost of constructing independent substitutional works has, for reasons already fully set forth, little relation to the actual value of existing structures save as such studies may throw light upon the question of the wisdom of the adopted plans after which the works have been built.

Unless such estimates can prove the existence of gross and inexcusable error in the adopted plans, they are not entitled to great weight in determining the value of existing structures.

In determining the value, however, of any combination of real estate and water rights which have together been made a source of water supply for which there exists a demand, the estimated cost of creating an equivalent from the next most available source becomes at least one measure within limits of the present value of the properties and rights already acquired and in use.

This proposition rests upon the theory that since such enhancement of value due to general community growth and prosperity, to which a water company so largely contributes, is, in the case of individuals or private enterprises, always regarded as legitimate gain, there seems absolutely no reason why the properties of a water corporation devoted by process of law to the public use for no more than a fair annual return upon its value, should not share in such enhancement.

The writer has pointed out that this is entitled to special weight in determining the value of water producing properties when companies are compelled to carry them at their own risk and expense until such time as they are actually required for use.

APPRECIATION OF REAL ESTATE AND WATER PRODUCING PROPERTIES, AND ITS RELATION TO VALUE.

It seems clear that any determination of present value, if cost be used as the starting point, should be influenced by the appreciation, if any, that has taken place in real estate, water rights, and such like properties since their acquisition by the owners of the works.

It not infrequently happens, especially in the semi-arid sections of the country, that water rights and privileges and real estate so situated as to afford unusual natural opportunities for affording run-off and storage facilities of an exceptional character, though secured at comparatively small expense through increased demand, due to increase in population, become in time of greatly increased value.

Inasmuch as such enhancement of values is always regarded in the case of private enterprise as legitimate gain, and particularly since general prosperity, which creates such enhancement, is as largely fostered by a system of water works as by any other agency, there seems no valid reason why such increase of values above original cost should not accrue within limits to the advantage of the water company.

The actual determination of the present value of such assets must, of course, take into account the general scheme of which they form integral parts, and the final result as a whole to which they contribute.

No piece of property, however difficult it be to find a satisfactory measure of its value, can be counted as worth less than the cost of other as favorably situated tracts.

If this principle is applied to the combination of properties which, because of their having been brought together, have made possible the delivery for, possibly all time, of a suitable volume of potable water, then logically the amount of increase in value of such property or its present value would be sought in the cost of developing or otherwise obtaining an equally abundant and equally marketable supply from the next most available source.

This, then, is the justification for using the probable cost of a substitutional equivalent as at least strongly indicative of value.

This method will usually have its chief application and will most affect the final result in the case of those properties used for creating and safeguarding the sources of water supply as distinct from the distributing system in those regions of the West where the water supply is the great problem.

On the other hand, where the community has at hand inexhaustible sources of supply free to anyone at the cost of taking, water rights may have no value, and no increase in excess of cost then becomes ordinarily possible.

HAS THE FRANCHISE ANY VALUE?

The answer to this question depends upon what is meant by franchise. If a concern is actually earning revenue in excess of an amount sufficient to meet all costs of production, including a proper return upon the value of the property employed, it has become a very common practice to credit such surplus earnings to franchise. It cannot be denied that, under such conditions, by whatever name it may be called, this ability to earn a large surplus, where it has cost nothing, presupposes the entire absence ment of value.

It appears, however that the creation of any earning power directly attributable to franchise under this definition, and the consequent creation for it of real value when it may be exercised, constitutes an important ele- of regulation of rates on the part of government for the purpose of securing water service at no greater cost to the consumers than is consistent with fairness to the water company. In other words franchise, if it has cost nothing, is not necessarily an element of value upon which any revenue need in fairness be allowed by rate-fixing authorities. Indeed, the very purpose of the law, apparently, is to prevent such excess earnings as are here assumed to give value to the franchise.

If there are no legal restrictions, and a water company is allowed to collect such rates as seem to it alone expedient, it may easily be imagined that its earnings might, in many cases, be greatly in excess of what would net it a very reasonable, or even liberal return upon the otherwise value of its property, no matter by what rational method such value were determined.

Again, when water companies have by wise foresight and prudent expenditures acquired properties such, for instance, as lands and water rights, which by reason of their special adaptation to their purpose cannot be dispensed with without securing other properties productive of equivalent results at a cost materially in excess of the investments actually made, such enhancements of value have sometimes been credited to franchise.

This element of value has already been pointed out to be a very real asset; but it stands in a class by itself. To term it franchise value seems a misnomer, since it represents real value wholly independent of the franchise.

Again, the fact that a property possessed of and actually doing a large business capable of affording a sufficient revenue, is worth more than a similar property without such business, has sometimes been termed franchise value.

This, too, while doubtless a real asset, is better classed as "established business," and will later be again referred to.

The writer is, therefore, of the opinion that the first before-mentioned view of what constitutes franchise value is the correct one; that every other element of real value is more properly classified elswhere; and that under wisely drawn legal provision for the regulation of rates, no value need attach to franchise, either for purposes of taxation or revenue.

DOES ANY SPECIAL VALUE ATTACH TO THE FACT THAT A COMPANY HAS AN ESTABLISHED BUSINESS?

Mention has already been made of this element of value. It has been pointed out that a system of works, already possessed of sufficient business to make the property a profitable investment, is worth more than a similar property without a revenue.

That an established business constitutes a very real asset, would seem to be beyond dispute, but the money measure of its value is so difficult of determination that it has, at times, compelled resort to mere arbitrary opinion. Such a procedure is always to be avoided if a logical standard can be found.

It does not appear that such a standard is wanting where proper accounting has been employed; and its reasonableness lies in the fact that it is rooted in the necessities of water works construction and growth, as demonstrated by general experience.

This measure is found in the actual cost of establishing the business as ascertained by the losses during the early history of the plant, arising from the want of sufficient revenue to pay at least current rates of interest on the necessary investments. Reference has already been made briefly to this subject, but it is worthy a little further amplification here, even at the risk of some repetition.

The building of water works suited to prevailing needs, with liberal allowance for future increase, is a work of necessity for any modern city—a work which, especially in the regions of sparse rainfall, must, after the first nucleus is formed, precede rather than follow growth in population.

A suitable water service must be obtained regardless of the magnitude of the necessary cost.

Because of these facts it almost invariably happens, where local conditions render necessary heavy initial capital outlays, that to some extent the future must be discounted in the early financing of the enterprise. In other words, the limited number of rate-payers makes it impossible for the enterprise to pay adequate returns on the investment until the population and business industry, increasing under the stimulus of an abundant water supply and other causes, make possible an adequate revenue.

What is to be the return for this unavoidable additional source of expenditure in the establishing of a sufficient business? Its result is the creation of this asset of "established business," and the attendant expense is an actual measure of what it has cost to create it by the only means by which such an element of water works value can be created. Cost is, therefore, a rational measure of the value of this element, "established business,"

THE VALUE OF THE SERVICE RENDERED TO THE PUBLIC, AND THE LIMITATIONS IT IMPOSES UPON VALUE.

The value of an established water works property, no matter how great may have been its cost or how great a sum would be required to secure a substitutional equivalent, cannot, in the final analysis, be more for rate-fixing purposes than the capitalization of its greatest possible net earnings without restriction as to charges. In other words, the worth of the service to the consumers will always fix a maximum beyond which no theory of value, however plausible it may appear, can be followed.

What is the worth of the service to the consumers, and how may it limit the possible revenue, and thus limit the value of the water works property?

First—The service is not worth more to any consumer than it will cost him individually to secure an equivalent by pumping out of a well or from some other available source, if there be any; for, if the rate charged exceeds this amount, many will utilize such source in preference, with corresponding loss of revenue to the water company. The same holds good for all consumers collectively, save that in such capacity they may be expected to regard the public welfare as well as that of the individual.

Second—If there is no other possible substitutional supply, thus placing the water company in the postion of having an absolute monopoly, still the value of the service rendered cannot be worth more than the consumer can afford to pay interest upon, without impairing general prosperity and checking municipal growth.

To illustrate the above truths: If a water company were wholly unrestricted by any governmental agency in determining the amount of its charges, it would be folly for it to impose rates so high, no matter how great its necessary investment, as to invite destructive competition; and, if no competition were possible, it would be just as foolish for it to injure its present as well as its future business by imposing rates so high as to check general properity and retard municipal growth. A wise policy, and the one calculated to derive in the long run the greatest possible returns, would always seek to keep well within these limits; and, keeping within these limits, the property could not for rate-fixing have a greater value than the revenue then received could support.

If the investment of the water company should prove in the long run greater than the value thus justified by the permissible rates, the loss is chargeable to bad judgment on the part of the investors, and they should not be heard to complain.

When one attempts an inquiry as to the value of the service rendered in the specific case of any city, he finds himself, however, without any standards of exact comparison. Water rates charged in different places are indicative of general practice, but each is determined by widely varying local conditions and none may answer the question directly as to what is the maximum revenue that those local conditions would, if necessary, warrant. If, however, the rates in question are ascertained by comparison to be materially less than have been successfully imposed without evil results in other cities of comparable wealth and general prosperity, it may be inferred that the application of similar rates would, in the case in hand, be a safe procedure.

Again, if property, improved and unimproved, is enhancing rapidly in value, it is evident that the imposing, if need be, upon it of an increased cost of water service would accomplish no worse result than to divide the so-called "unearned increment" due to general increase in population in some proportion between water works and real property.

This phase of the subject then deals with the total gross revenues which the company should be allowed to collect, wholly regardless of the magnitude of its actual investment. Its application, therefore, requires the study of general taxation, as well as that imposed upon the company, the amount of revenue paid the company in compensation for public service, the cost to the company of operating and maintaining its works, the provision, if any, which should be made annually for liquidating investments in perishable structures or others which ultimately require abandonment, and the rate of interest which the property is entitled to earn over and above all expenses.

While only general conclusions can be drawn from so complex a study, they can, with the exercise of care, be made sufficient to establish the limitations sought with a degree of accuracy suited to the demands of substantial justice.

FINAL SUMMARIZING OF CONCLUSIONS AND DETERMINATION OF PRESENT VALUE.

Having considered the various hereinbefore enumerated factors likely to influence the value of any property under consideration, and having summarized the results, it will remain to determine the varying degrees of importance and weight to attach to each, and to decide, in view of all the attendant circumstances, what the amount is upon which the water company is entitled to receive a suitable return.

As has been stated at the beginning of this paper this final solution can never be reduced to a mathematical formula applicable to all cases. The before-suggested inquiry

will have established approximate limitations both as to maximum and minimum, but there will, even then, usually be found remaining quite a wide intervening field for the exercise of individual discretion.

That the final result will so largely depend upon the personal equation does not, of necessity, detract from its worth. It only shows the greatness of the problem which requires for its solution the exercise of faculties higher than the application of mere formulæ and mere routine, faculties which are rooted in laborious thought, in ripe experience, in moral worth.

Justice in dealing with such highly abstract questions calls only for the best that can be had, and nothing less; and the best will always be found sufficient for its ends, for this it is which determines our highest natural sense of justice, itself, upon which all law must finally rest.

LATEST DEVELOPMENTS IN SINGLE PHASE MOTORS FOR COMMERCIAL POWER PURPOSES.*

BY W. A. LAYMAN.

No form of electrical apparatus has illustrated more effectively than the single-phase alternating current motor the principle that modern designing engineers are seldom baffled for any length of time in the production of a commercial device for which a crying need exists. This type of apparatus was slow in making its first successful appearance, as compared with the polyphase alternating current motor, but this fact was due more to the early belief on the part of central-station men that the polyphase motor solved practically all the requirements of commercial central station service, than any inability to produce a successful form of motor. It was not very long subsequent to the successful introduction of the polyphase motor that single-phase motor designs capable of successful development were suggested, but the development of these designs was deferred, due to the fact that some of the most energetic manufacturing companies were more interested in responding to the central station man's belief that the polyphase motor met all the conditions than in creating a demand for a single-phase type of motor. In the early days there did exist for quite a time a demand from small stations for a high frequency single-phase motor, but as the various successful types of polyphase motors made their appearance, central station men drifted into the belief that it was better to abandon all attempt at single-phase power distribution and utilize the polyphase motor.

For a while this theory was not confronted with any serious commercial obstacle, but with the rapid development of local distributing systems, the engineers soon began to see that a general local polyphase system for both lighting and power involved a good many serious objections notably,

(a) The cost of installation to the central station of a comprehensive polyphase distribution network.

(b) The difficulty of satisfactory pressure regulation of lighting service on a polyphase distributing system.

*A paper read before the Electrical Transmission section of the Pacific Coast Engineering Congress, held at the "American Inn" under the auspices of the Lewis and Clark Centennial Exposition, Portland, Or., June 29-30, 1905.

With a growing appreciation of these difficulties, manufacturers also began to more clearly appreciate the desirability of the development of a successful form of single-phase power motor. Therefore, dating from 1897 the development and the use of single-phase motors by central station people has expanded with great rapidity.

There first appeared motors of one to five horsepower capacity. Quickly as the demand called for them, the sizes ran up to forty horsepower, until to-day manufacturers would probably be willing to undertake the manufacture of single-phase motors of almost any capacity, for which sufficient demand appeared to justify the manufacture.

The first successful single-phase motors placed on the market were introduced without regard to starting current. After central stations became satisfied that this form of motor was a complete success, the call developed for some form of current control by which starting currents could be held down to reasonable amounts. This requirement was quickly responded to by the manufacturers introducing starting devices which with at least one form of motor on the market curtailed the starting current under full load starting conditions to currents not more than 25 per cent. in excess of full load current.

The earlier forms of single-phase motors provided for constant speed service only, and until a comparatively recent date manufacturers have not supplied motors capable of speed variation or external control of reversal of direction of rotation. Central station men began to urge the development of variable speed motors suitable for ventilating fans, traveling cranes, hoists, elevators and other types of special service, with which no effort was made at an early date to cope. The result is that manufacturers are now responding with these various types of single-phase motor refinement. There has recently been placed upon the market a limited range of sizes of motors capable of taking care of these heretofore impossible kinds of service. It may be interesting to this convention to consider somewhat in detail the developments being made in this sort of equipment.

VENTILATING SERVICE.

The direct-connected ventilating fan outfit is one of the most satisfactory forms of direct current motor development. There unquestionably exists a large field for the application of the single-phase alternating current motor in this same class of service. At least one manufacturer is now ready to supply a limited range of sizes of direct driven ventilating fans, the single-phase motors being attached thereto being capable of speed range of eight to one in sizes of one to three horsepower inclusive, and two to one in the larger sizes. In the smaller motors this control is effected with an auto-transformer by means of which there is applied to the motor a voltage corresponding to the desired speed of the fan. The form of motor employed is the standard commutator type of the Wagner company. The automatic governor is so arranged as to become operative in case of trouble with the fan only, thus acting as a safety valve in preventing the running

away of the outfit in case of the removal of the load. The brushes bear on the commutator constantly. In the larger sizes at this time an armature resistance control is employed, the motor being of the type employing a single-phase induced field winding, and polyphase induced armature winding.

CRANE AND HOIST SERVICE.

Motors of two types are now available for this kind of service—(a) series, (b) the Wagner repulsion type. In the former form, the commutator is used continuously without difficulty; the latter form is the standard Wagner type supplied with suitable windings for reversing and speed control.

ELEVATOR SERVICE.

Perhaps in the field of elevator work manufacturers have found it more difficult to develop a successful form of motor than in any other kind of single-phase motor service. There has existed for several years a demand of this character on the part of central station men, and some central station men were beginning to believe such a motor was not going to make its appearance, but the manufacturers have finally responded, and at least one very successful form of motor for this service is now available.

The Wagner Electric Manufacturing Company has recently announced a type of motor which is the invention of Mr. Leo Schuler, a German engineer. The motor is capable of the same speed control, current control, and reversal of rotation as is the well-known form of direct current elevator motor. The manufacturers claim the performance of the apparatus to be substantially equivalent in every way to the best direct-current elevator motors.

In electrical performance, this motor is a combination of the repulsion and induction forms of single-phase motor. Mechanically the motor consists of an ordinary induction motor frame. It has an ordinary induction motor stator core, built up of laminated sheet steel. The stator winding consists of form-wound coils, distributed in slots around the inner periphery of the stator core. The motor is built up of laminated steel the same way as the stator and carries a progressive wave winding similar to the usual direct-current armature; on one side is provided a commutator, and on the other side three collector rings connected into the winding in polyphase relation.

In operation, the first effort of rotation is secured with connections corresponding to the well-known repulsion motor. After the armature has attained about one-quarter speed the polyphase resistance, connected to the armature through the slip rings, is thrown in, and gradually short-circuited as the armature runs up to full speed. The brushes bearing on the commutator in the usual elevator equipment are not completely short-circuited, but have a fixed resistance interposed between them; at no time are the brushes removed from the commutator.

The repulsion type of motor has starting characteristics very similar to those of the direct-current series motor, that is, a very heavy torque is secured at the first instant of starting. This torque decreases rapidly as the speed increases. Correspondingly the current taken by the stator winding from the outside supply circuit also decreases rapidly, and this is also the case with the current through the repulsion brush circuit. On the other hand, in the single-phase induction motor the torque on the rotor at rest is zero, but increases gradually to a maximum as the speed increases toward full speed. By making use of a combination of these torques, the inventor of this motor has developed a machine that has exactly the torque characteristics necessary for elevator and hoist service, and has substantially combined in a single machine two heretofore well-known forms of single-phase motors.

The connections of this motor are illustrated in Fig. 1, and the general appearance of the motor in Fig. 2. It is

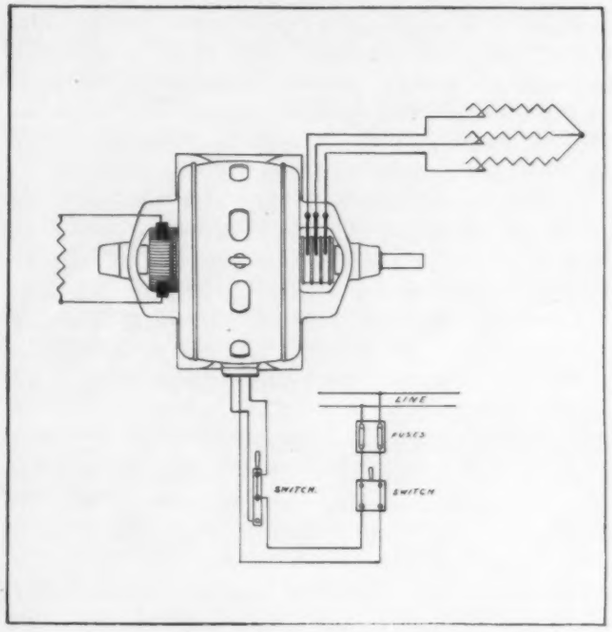


FIGURE 1. CONNECTION DIAGRAM OF WAGNER SINGLE PHASE VARIABLE SPEED MOTOR

claimed that the commutator service is exceedingly satisfactory, and the life of the commutator equal to that of a good direct-current elevator motor. The same form of motor is applicable to a good many other kinds of service, as, for example, crane work.

The announcement has recently been made by another manufacturer of a series form of motor for this same class of service. It is claimed that this particular type of series motor is admirably adapted to elevator motor work. As between the repulsion-induction type illustrated in Figs. 1 and 2 and the plain series motor for elevator service, the former would appear to have one distinct advantage, in that on the down trips the armature acts as an electric brake, and thus provides a speed control which would appear to be lacking in the series type of motor.

OTHER FORMS OF SINGLE-PHASE MOTOR DEVELOPMENT.

In passing it may be of interest to note the rapid development of the series motor in the field of large apparatus and particularly street railway work. There have been published recently very flattering trade journal reports

of trials of a Westinghouse 135-ton single-phase twenty-five-cycle locomotive. Similarly there have been very successful trials, and, in fact, actual commercial installations, of very successful interurban single-phase railways. All these improvements are of great interest to the central station men, both in the lighting and railway field, as indicating the practically complete conquest of the full range of commercial power motor requirements by the single-phase type of motor.

SOME ASPECTS OF SINGLE-PHASE DISTRIBUTION.

This paper may with propriety touch upon some aspects of single-phase distribution in so far as the topic has a bearing on the use of single-phase motors. A number of questions are occasionally asked as to the chief advantages of the single-phase type of motor, for the central station man. For example, "Why should a poly-phase transmission system employ single-phase motors?" Chiefly because better combined lighting and motor service can ordinarily be given from local distributing centers over single-phase than over polyphase circuits. A polyphase transmission line, can, with admirable simplicity, be subdivided at a local distribution center and single-phase distributing circuits employed to supply a large percentage of power users as well as all lighting users. These single-phase circuits are capable of entirely independent pressure regulation, and the uneven distribution of load on the individual feeders becomes a matter of secondary importance under these conditions. The simplicity of such an arrangement, and the superiority of the service to the consumer by virtue of better pressure regulation are arguments which cannot be controverted. The only limit to a distributing system of this sort is set by the occasional occurrence of a larger power user requiring motors of large individual capacity. Manufacturers at the present time do not supply such motors in the single-phase type, although there is doubt that central station men by the proper insistance, could bring about development of such single-phase apparatus. The lower cost of the single-phase distribution network with its single-phase type of transformer, is an accepted and fully appreciated fact by nearly all central station men.

"Is there not a great disadvantage in the higher cost of single-phase motors as compared with polyphase?" is another question sometimes asked. It is true single-phase motors are substantially more expensive than the polyphase. This is naturally the case, since a given volume of material produces considerably less output as a single-phase motor than as a polyphase motor, just as does a given volume of material produce a much smaller single-phase generator than polyphase generator. It is also true in a measure, for the further cause that the construction of single-phase motors is, in a number of detail respects, much more expensive than the polyphase, but the cost of the motor is not the controlling element of the situation. Simplicity of distribution, and less cost of distribution, are the controlling features in the situation. In very few instances does the central station man supply the motor to the customer. He may act for the customer and allow the customer the full benefit of such price concessions as he may be able to secure from the motor manufacturer, but he is more vitally interested in what it is going to cost him to expand his system to take on a particular customer's load than he is in what it is going to cost the customer in the way of apparatus. Of course, the sale of current is promoted by the central station man securing for the customer the cheapest prices possible on current consuming devices, but the central station man cannot afford to ignore the fixed charges of his own plant in order to contribute to the cash balance of a consumer. In the electrical business, as elsewhere, "Charity begins at home." Unquestionably, with the wider use of the single-phase type, the cost of such motors is going to be reduced, and the central station man can lend an eye to his own proper system of distribution somewhat to the exclusion of the selfish interests of the consumer with the

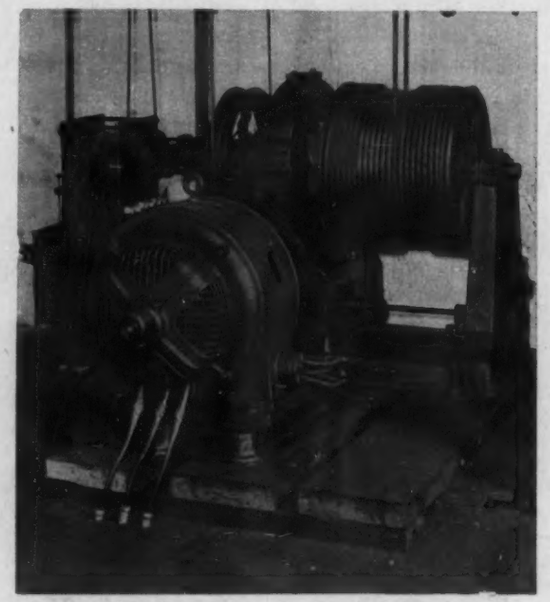


FIGURE 2. WAGNER SINGLE PHASE VARIABLE SPEED MOTOR

reasonable expectation that eventually some of the price disadvantages to the consumer in the use of the single-phase type of apparatus will disappear, although all of this disadvantage can never disappear owing to the much greater inherent cost of production of the single-phase type.

There is a strong tendency in the development of some of the later forms of polyphase power motors to very much curtail the mechanical output in view of the keen competition developing as the result of the expiration of the fundamental polyphase patents. It so happens that in the manufacture of some of the best forms of single-phase motors now on the market a curtailment of the mechanical output is impossible, unless the starting capacity of the motor be also sacrificed. With the polyphase, full load can be run up to full speed, even though the maximum load capacity of the motor be only equal to the horsepower rating of the motor. Such is not the case with the prevailing single-phase type. To supply full load starting torque, the motor must necessarily have for temporary service considerable overload capacity. Thus the

quality of the single-phase motor cannot be impaired to what may be termed the fatal extent, by commercial competition.

The writer is an enthusiastic believer in a most expansive future for the single-phase alternating current type of motor. This does not arise from an excessive interest in the single-phase type of construction, since the manufacturing company with which he is identified is now prepared to also supply polyphase apparatus. This enthusiasm, on the contrary, is based upon the sincere engineering belief in the correct use of the single-phase type of apparatus founded on sound distribution principles. That many of the limitations of the single-phase motor are now a matter of past history, is a cause for general congratulation.

ON THE COST OF IRRIGATION BY ELECTRICALLY DRIVEN PUMPS FROM TRANSMISSION SERVICES.*

BY W. W. WHEELER.

When a transmission system arrives at that inevitable stage of development wherein it reaches into outlying farming communities for the purpose of building up a pumping load as well as of developing the productiveness of the country that is to be tributary to its lines, the question that is most frequently asked is: "What will it cost to irrigate an acre of land with water pumped by electrical power?"

To answer this question with any close degree of accuracy requires an intimate knowledge of the conditions which prevail regarding several factors—namely, the cost of power, the character of the lands to be irrigated, and the depth from which the water must be raised. My own experience is mainly confined to the territory covered by the transmission circuits of the Northern California Power Company, operating in that portion of the northern part of the Sacramento Valley contained in portions of Shasta, Tehama and Glenn Counties in Northern California, an experience which this paper reflects.

In the popular mind irrigation implies a gravity or surface catchment for delivering water to the land, but in recent years pumping has become more and more recognized by engineers as the most economical means for supplying water for all irrigating purposes, and it is destined to grow in importance as the cost of power becomes less through the development of transmission enterprises. Lands that lie beyond the economic reach of gravity supplies of water are often entirely reclaimable by pumping, and numerous cases exist where both systems are available for use, but in practically every case the advantage as to cost and operating expense is found to be on the side of the pumping plant. The vagaries of the wind make the windmills unreliable, gasoline engines though very efficient as to fuel consumption require great care and are expensive to install, steam power is not to be considered except in large units because of the heavy first cost and the expense of operation and attendance, but with electric power rests every advantage in cheapness of installation and operation. These plants require practically no attendance and the power is reliable.

Of the many types of pumps available and in use of irrigation use the most common perhaps is the centrifugal pump, which is made on the Pacific Coast in standard sizes ranging from two inches to fifteen inches in suction and discharge pipe diameters, and on special order can be made in any size required. The first cost for a complete electric motor and centrifugal pumping plant will depend on the size of the plant and the type of motor used. For small plants capable of irrigating one hundred acres or less, the first cost will usually range from twelve dollars to fifteen dollars per irrigated acre, while the cost of operation will be found to vary from two dollars and seventy-five cents to three dollars and seventy-five cents per irrigated acre.

In this connection it will be of interest to refer to an estimate recently made by the United States Geological Survey for an extensive pumping system designed to irrigate some 300,000 acres of land in the San Joaquin Valley of California. This estimate indicated the first cost of the plant to be about four dollars per acre, and the annual cost of operation and maintenance to be about fifty cents per acre-foot, or approximately one dollar per year per acre irrigated. When it is borne in mind that the average cost of installation of gravity supply systems in California has been about thirteen dollars per acre, and that the annual charge for irrigation averages one dollar and sixty cents per acre, the great possibilities of pumping can be appreciated.

The circuits of the Northern California Power Company extend down the Sacramento Valley from Redding as far as Vina in Tehama County on the east side of the Sacramento River, and Willows, Glenn County, on the west side, and as a general statement it may be said that within this great district land can be irrigated for one hundred days, which covers the period of the year during which irrigation is necessary, at a cost of two dollars and fifty-four cents per acre. In this the water which will be distributed is equivalent to a twenty-four-inch rainfall. This estimate is based on water being lifted from a depth of thirty feet to irrigate a tract of one hundred acres of land, and the expenditure necessary for so doing would amount to fifteen dollars an acre for the installation of a centrifugal pump direct driven by fifteen-horsepower induction motor. The cost for power for this period of one hundred days in the territory defined, is at the rate of thirty-five dollars per horsepower year, and the cost for maintenance is practically nothing. In fairness, however, due cognizance must be taken for the interest on the money invested and as the cost per acre for a pumping plant to irrigate a one-hundred-acre tract is fifteen dollars, the interest on this investment for one year at six per cent. is ninety cents. This amount should be added to the two dollars and fifty-four cents paid for power, making the total cost per acre for the irrigation necessary during one year to be three dollars and forty-four cents. If to this

*A paper read before the Electrical Transmission section of the Pacific Coast Engineering Congress, held at the "American Inn" under the auspices o the Lewis and Clark Centennial Exposition, Portland, Or., June 29-30, 1905.

be added the very liberal estimate of six cents per acre for incidentals, the total cost will not be far from three dollars and fifty cents per acre per year.

Some specific instances will prove convincing: At Redding there is a pumping plant consisting of a fifty-horsepower type "C" Westinghouse induction motor, belted to an eight-inch horizontal centrifugal Jackson pump that delivers eighty miners' inches of water under a pressure of twenty-four pounds per square inch, and with a suction lift of fifteen feet, through 4500 feet of eight-inch riveted pipe. This plant supplies water for gardens, orchards and alfalfa lands, and the water is sold at the rate of ten cents per inch per twenty-four hours' service.

About one mile south of Redding a seven and one-half-horsepower type "C" induction motor, belt drives a four-inch Jackson centrifugal pump of the vertical tower type, which lifts 275 gallons of water a minute to a height of twenty-seven feet for the irrigation of twenty-five acres of alfalfa. This plant was installed about three years ago and the owner is authority for the statement that during the first year of its operation the increased productiveness of the land, because of irrigation, enabled him to clear enough therefrom to pay for one-half of the first cost of the plant in addition to his yearly power bill, amounting to $175.00.

About a mile further down the Sacramento River a somewhat similar plant is being installed. This plant consists of a ten-horsepower type "C" motor belted to a No. 5 Gould centrifugal pump which will lift water to a height of thirty-two feet for the irrigation of fifteen acres of alfalfa and six acres of garden land.

At Anderson the Bellevue Irrigation Company is operating a fifty-horsepower type "C" induction motor, which is direct connected to a ten-inch Krough "Patented California pump" having a double eight-inch suction and a ten-inch discharge opening. This equipment, which is securely anchored to bed-rock, is placed over the water on a platform that is eight feet above the low water mark. The two suction pipes project about three feet below the surface of low water, and are surrounded by floating wooden platforms the purpose of which is to prevent the formation of whirlpools and the sucking of air into the pump. The discharge pipe, which is eighteen inches in diameter and fifty-four feet long, is made of No. 16 steel with flanged joints bolted together and connected to the pump by means of a taper joint. This plant shows an efficiency of 72% and discharges 489.8 cubic feet of water per minute into a large wooden box located at the head of the ditch leading to the reservoir. This ditch is 1800 feet in length, and for a distance of 600 feet it is built up eight feet above the ground. Its grade is one-eighth of an inch to the rod, and measures seven feet across the top, four feet across the bottom, with a depth of three and one-half feet. The reservoir, which is nearly circular in form with a diameter of 200 feet, was formed by scraping up dirt and throwing it up into a levee, and when filled holds approximately 160,000 cubic feet of water. The main canal leading from the reservoir is 7850 feet long, ten feet wide and four feet deep, and at its lower end there are three measuring boxes each feeding lateral ditches for distributing water over some 400 acres of prune orchard and 100 acres of alfalfa. Water from this system is sold at the rate of ten cents per miners inch, under a four-inch pressure per twenty hours. It may be added that in or about Anderson there are several small pumping plants, ranging in capacity from one-half to two horsepower.

At Cottonwood there are also several small plants of the sizes last indicated, together with a number of others, one of which consists of a five-horsepower Wagner single phase motor belted to a three-inch vertical centrifugal pump of Krough manufacture, which lifts 215 gallons of water per minute to a total height of twenty-six feet through a six-inch casing pipe about forty feet long. This pump irrigates twenty-six acres of alfalfa, and last year the total cost of power for its operation was $65.40.

At Red Bluff a thirty-horsepower type "C" induction motor operates by belt connection an ancient type of five-inch Jackson centrifugal pump which is used for the irrigation of 135 acres of orchard lands. The plant raises 315 gallons of water forty-eight feet high through 900 feet of ten-inch pipe, and last year the cost of power for its operation was $314.11.

Several pumping plants are to be found at Red Bluff, but perhaps the most interesting consists of a seven and one-half-horsepower Wagner single phase motor which is belted to a No. 2½ Fulton power head for the operation of a cylinder 5x80 inches in size. This cylinder is placed eighty-nine feet from the top of the well which was bored by the County of Tehama for experimental purposes with the idea of ascertaining if it were possible to obtain artesian water. Originally the well was drilled to a depth of 1,375 feet, but as a natural flow of water was not obtained at that depth, it was decided to open out the well with dynamite. Owing to an accident, however, the charge went off prematurely in the neighborhood of 500 feet from the top, with the result that its depth is now only 475 feet, but it gives an unlimited supply of water. It is a ten-inch bored well with steel casing.

Three miles below Red Bluff on the Sacramento River there is a twenty-horsepower induction motor which drives by direct connection a Krough centrifugal pump that lifts 1600 gallons of water per minute to a height of twenty-six feet with a total or over all efficiency of 69%. This plant irrigates eighty acres of alfalfa; it runs approximately eight days during each five weeks, and the land it irrigates raises annually seven crops of alfalfa at a cost of $185.00 per year for power.

At Tehama there are several small plants most of which are for domestic and household uses, but one of them is worthy of special note in that it consists of a three-horsepower Wagner single phase motor driving by direct connection a Gould triplex plunger pump which supplies the town with water.

At Corning there are in particular two ten-horsepower plants each of which furnishes water for the irrigation

of orange groves, each motor being of the induction type and connected to its respective pump by belting. In the first installation a tower type Byron Jackson two and one-half-inch pump lifts water a total of 135 feet through two lines of three-inch redwood pipe, each 1100 feet long, whence the water is delivered to a reservoir from which it flows by gravity over a forty-acre orange tract. The cost of power for the operation of this plant last year was $225.00. In the second plant a three-inch centrifugal pump of the horizontal shaft type lifts water to a height of sixty-five feet through 350 feet of five-inch standard screw-iron pipe into a concrete reservoir forty feet long, thirty feet wide and twelve feet deep, whence it is drawn through ditches for the irrigation of thirty acres of orange land. In this plant last year the cost of power was $223.15.

At Corning and Orland there are some twenty-odd electric pumping plants which range in capacity from one-half-horsepower up to seven and one-half-horsepower and are used for various purposes, such as watering stock, irrigating orchards, berry patches, vegetable gardens, lawns, and for general household purposes.

Why electrically-driven pumps are not more generally used in irrigation when the service is rendered at such comparatively light cost of installation and operation, is beyond comprehension, particularly when the great increase in productiveness which results therefrom is taken into consideration. It has been suggested that a favorable field for a business enterprise exists in encouraging irrigation by means of electric power through the organization of a company that will install electric pumping plants to be paid for under easy terms out of the guaranteed increased production of the land. That such an enterprise would be profitable is not to be doubted, for while there is so much rain in the upper Sacramento Valley, for instance, that farmers and orchardists can raise fair crops without irrigation, this very fact has deterred them from investigating the big profits to be made by irrigating their orchards and fields. Even if they do understand the great benefits to be derived from irrigation, they seem to rest content in the belief that some day some million-dollar company or the government will undertake the great enterprise of building a canal to convey water from the river to their bench lands. This day dream will not be realized for years, and in the meantime their profits are by no means those which would accrue were modern engineering methods impressed in their service. By irrigating by electrical power each small land holder can own an independent irrigation system the cost of which may be accurately determined before its installation, and similarly its profits can be closely predetermined. There is no hazard.

The skill with which the Portland street car lines handle the crowds of visitors to the Lewis and Clark Exposition is a matter of favorable comment from all quarters. Though from 15,000 to 30,000 people ride to the fair every day, there is practically no crowding, and the conductors are winning praise for their uniform courtesy and attention to the passengers. The Exposition is only fifteen minutes ride from the business center of Portland.

COMMERCIALISM AT GAS ASSOCIATION CONVENTIONS.*

BY LUCIUS S. BIGELOW.

Though recently I had the honor to become identified with you as a member in this esteemed Association, I could but feel that membership at this time, without attendance would be too far-distant a form of kinship, therefore I have, as Mr. Lowe has just stated, crossed a continent with the desire to be accepted as one of you in true Pacific fellowship.

Our esteemed president, Mr. Lowe, has assigned to me a duty which as a loyal member I must essay to perform. It is, so the program says, to speak upon the subject of "Commercialism at Gas Associations' Conventions."

This topic is indeed an important one, for is it not so that in the commercial or sales-promoting side of the industry lies much of its dividend-earning capacity?

The gas enterprise of to-day is largely composed of two distinct divisions:

First—The Manufacturing, which naturally includes distribution.

Second—The Selling.

To the first I should say belongs the duty of producing the element, providing holders and piping-systems through which to deliver the gas. These are purely engineering propositions.

How shall we dispose of the gas after it is in the holder? That is the question which the commercial or sales division must answer.

For years there have been gas associations—they were started when the gas companies confined themselves to the making of gas, coke and tar. These associations have done much to cultivate skill in the various branches of gas engineering, and to hasten the introduction and use of more modern methods in gas manufacture, as well as the adoption of approved means for delivering the product under high pressure and to long distant points. Thus the original plan and intent of these associations, so I am told, has been, and is being well fulfilled.

In these later days, the industry is confronted with an added responsibility, namely, a commercial or sales-promoting side. In this connection many gas companies have already asumed the responsibility of becoming merchants in that they buy and sell ranges, burners, mantles, water-heaters, and other devices and supplies. In some cases this has been done to the extent of creating considerable friction between local hardware, stove and other merchants and the gas company.

Other companies are also energetically doing extensive sales-promotive work but are so conducting their campaigns as to throw the sales into the hands of the local merchants, thus directly co-operating with them for the purposes of harmony and the enlisting of their assistance, and through them the aid of their friends, during present and future periods of extensions, etc.

There are other gas companies that are doing neither,

*A paper read before the Thirteenth Annual Meeting of the Pacific Coas Gas Association, July 18, 19, 20, 1905, and the publication of which in THE OURNAL for August was inadvertently omitted.

seemingly satisfied with what business they can secure without "going after it."

Here are three ways now followed and there are doubtless many others. The question arises: How are we to discover them, and how are we to judge which of the many is the best method under certain conditions?

Some companies advertise largely in local papers, to gain publicity and favors; some do no, or very little, advertising; others employ a goodly number of solicitors, thus to visit personally every house and shop in the territory. Again I ask: Which is the best way?

While few plans *in toto* will work well in all towns or cities, modifications thereof are frequently found both adaptable and profitable. On the other hand, listlessness or apathy on the part of a gas company can never hope to bring it clever results. Such too is a retarding element in the enterprises at large and should be dispelled.

There are many commercial methods in vogue here and there with gas companies, that if put into active service by others not using them, would bring most surprising returns to their coffers. How can we learn of these, and other methods, and how may we ascertain more about the results enjoyed by those adopting them? Also, how may we dispel apathy in the fraternity?

These questions lead us directly to the subject before us, and I would suggest as an answer: Let every gas company in the United States that is willing to give and take ideas, send a clever commercial representative to such gas association conventions, from year to year, as shall present the largest opportunity for consultation, agitation and interchange of ideas, plans and experiences along commercial lines. The stay-at-home man, or company, will never prosper, nor help others to the fullest extent.

I have been asked: "Can a gas company afford to send a representative to any considerable distance to attend a convention giving its especial attention to commercial gas matters?"

My response is: "Can any gas company afford not to send such a one?" Suppose it should cost a company one or two hundred dollars or more to send an "Absorbant" (as I might term him) that would return full of ideas, which, put into practice, would increase the sales of gas by several thousands of dollars a year; would the investment be a profitable one?

Gas companies as a rule differ from other merchants in that they have nothing along promotive or sales lines to conceal from one another. Herein great virtue lies and exceptional possibilities present themselves. Such being the case, "the other man" is sure to get fully as much as he gives, sometimes more.

A convention is the natural place for personal touch. It is a great clearing-house for ideas. The very thought, under such conditions, of a company saying "We can't afford to send our man" seems indeed absurd.

Let me ask, can we get too much commercialism or can we consider and exchange too many sales promotive ideas and plans at a gas convention? I say "No!" Yet a great difficulty has existed throughout the past in that there have not been hours or sessions enough in the older association conventions that could be devoted to this commercial side of the industry in order to do it full justice, without seriously pruning down the number and length of the many important engineering subjects that naturally present themselves.

It was the existence of such a condition which led me last November to suggest through the columns of my magazine, *Light*, that there should be a national commercial gas association, at the meetings of which naught but sales, appliances, business conduct, gas advertising and other similar commercial subjects should be presented or discussed.

The plan recently came to fruition and that association is to-day in operation, with Mr. William J. Clark of the Consolidated Gas Company of New York City as its first president. Its first convention will be held in New York next January. Over fifty gas companies (some of the largest in the country) are already represented in its rapidly growing membership. I hope to see most genuine co-operation between the older association and this newer one that has a special work before it in this, its especial field. There is, as you see, not even a thought of association competition in its make-up. It is simply the dividing of work, whereby to gain largest returns for the gas enterprises of the United States.

There has, heretofore, in most of the convention programmes, been exceedingly little commercialism. This brief treatment of so important a matter cannot hope to bring best results to the industry, while on the other hand, collectively produced, and considered at one convention, these various commercial subjects will afford all in attendance a most clever opportunity to absorb a maximum amount of beneficial and valuable sales-promotive information.

"In union there is strength."

I have thought that should the old association, or certain of them, unite, and form one splendid institute of gas engineers, or a national gas engineers' association, which would be a parallel of the American Institute of Mining Engineers, of which type of association there is but one in the United States, that then we should have one institute of gas engineers of the United States, or national gas engineers' association, and one national commercial gas association—and that the meetings of both might be arranged as follows:

Select five days, once a year, set apart the first two of the five for the sessions of the gas engineers' association, which would be conducted for and by engineers, and under its own organization.

Take the last two days of the five for the convention of the commercial association, which would be conducted under its own rules and by men representing the commercial side of the industry. Thus you have so organized and officered both of our associations as to secure best results in a most systematic and satisfactory manner.

Professional men prefer to be officered over and controlled by professional men and rules, while business men like commercial control and guidance. It is quite natural.

By this plan you will get the active help and services of not a few very clever men who have till now taken little or no interest in gas association matters. The plan I suggest, sets the middle day of the five apart as a day for social intercourse, excursions, banquets and the like, in which all, the engineer, the business man and the appliance or supply man should join.

Note how this would economize in both time and expense. The man desiring to hear only the papers and discussions upon engineering subjects, and enjoy the social functions, would come for the first three days and would hear and secure all and only what he came for. He could then, without wasting time, return home.

The business or commercial man who might wish for only the commercial or sales-promoting subjects, could remain in his office at home till just in season for the last three days—while the man who might wish to hear all could stay entirely through the five days.

In these busy, strenuous days, the man who is purely an engineer, or the exclusively business man feels in many cases an inability to spare more than just sufficient time to absorb his especial subject.

This plan would meet all conditions. If the idea suggested were adopted, I can then see a means of having once each year a fine national display of latest equipment, supplies and appliances required in the construction and sales end of the industry.

A large assembly room could become the scene of a most interesting exhibition that would attract the public during certain hours, thus stirring up that city for gas, and during certain other hours afford the gas men an opportunity to actually see and have explained to them many a device which otherwise they would know of only by advertisement, circular, or word of mouth of a traveling representative.

The exhibition of devices, etc., could open with the first of the five days and remain open until the close of the fifth.

It should be under the control of the commercial gas association not of the appliance men, thus to avoid competition for "plumbs" and the obscuring of the man with lesser "pull" or power among his fellow-manufacturers, yet who may have a device that the gas man believes in and which should enjoy equal prominence with the rest.

Every man exhibiting would naturally want the best he could get, and he would be apt to crowd his competitor, if the manufacturers controlled the exhibition. So, as I have said, it would be well to have the exhibition each year under the control of the commercial gas association.

You have heard, gentlemen, what my thoughts are upon commercialism at gas associations' conventions.

I believe you can't have too much commercialism, but I also firmly believe that there should be a place for it, when and where it will not crowd the important engineering subjects, or be crowded itself.

I desire to compliment the Pacific Coast Gas Association, of which I am proud to be a member, upon its progressiveness and purpose not to overlook or minimize the commercial side in its consideration of gas subjects. This is displayed by the program of topics presented at this, its meeting of 1905.

Let me thank you, Mr. President, and you gentlemen, for the many courtesies I am receiving while here with you, and as secretary of the National Commercial Gas Association let me extend from it to you the right hand of fellowship.

WATER POWER AS A FACTOR IN INDUSTRIAL DEVELOPMENT.*

BY CHARLES H. BAKER.

Many centuries ago, in a prehistoric era, the earth was chaos. Following this the forces of nature began to operate, and the heat of the sun caused the earth to take on its surface the plumage of a luxurious vegetation, now known only to the students of geology. Then came fire and destruction and earthquakes and upheavals, burying the forests and plant life of that remote era and giving place to a new generation of vegetable and animal life. These periods were repeated as the centuries went by, one geological age succeeding another, but each one storing in the bosom of the earth the carboniferous substances and latent heat, which during the process of subsequent centuries, has given birth to the modern coal fields of the world. Then, through the invention of James Watt and the development of steam machinery which has followed, this fuel has become a source of power to drive the various engines and machinery used in the mechanical arts.

Now, at the present time, the same sun which warmed into life the plants and animals of several thousand years ago, to-day uplifts from the oceans the water thereof in the shape of vapor and clouds, and this same sun, by virtue of its radiant heat, unsettles the atmospheric equilibrium so that winds result, and by them the clouds are driven from over the ocean and intercepted by the mountain peaks, the moisture is precipitated in rain or in snow which is stored upon the mountain slopes and in the hills and valleys, all of which gives rise to the little rivulets which in turn unite and make great rivers. And then the attraction of gravitation draws these rivers downward to the sea, falling, gushing, tumbling over precipices in their incessant effort to reach the ocean level again; the process repeated again and again forever.

In the one case is the latent energy of coal, the work of thousands of years to conserve; in the other is the energy of falling water, the work of a few hours. The efforts of the ancient and the modern sun stand face to face, and with what relative results? Out of coal we get perhaps ten per cent., in the form of mechanical power, of the energy which is stored within it. Out of falling water we get sixty-five per cent., even after subtracting the losses due to electrical transformation and transmission. In the

*A paper read before the General Engineering section of the Pacific Coast Engineering Congress, held at the "American Inn" under the auspices of the Lewis and Clark Centennial Exposition, Portland, Or., June 29-30, 1905.

case of coal we have to dig and mine and transport it, shovel it through furnaces, and rake out the ashes, all of which keeps busy an army of men. In the case of falling water the development of the power is largely automatic, the fuel bill for all time is probably part of the original installation cost, the labor is reduced to a minimum, and the cost proportionately. It is therefore apparent that an industrial community, having a water power at its door, under a liberal license, will thrive as against a community depending upon the coal fields, similarly situated and conditioned.

It is interesting to note in this connection the evolution of the motor from the primitive stage down to its present form. The prime motor is, or was, either man himself, or the beast of burden. M. Charvet, who has studied the subject, finds that a French laborer working eight hours in turning a crank at a wage of seventy cents per day, produces one horsepower unit the cost of which is eighty-five cents. The ox, turning a horizontal bar thirteen feet long, as in some grinding mills, produces the horsepower unit in the same length of time at a cost of twenty-three cents. A horse, doing the same kind of work, travels much faster than the ox, and his unit of work costs a little less than twenty cents. But a steam engine, working one hundred and fifty days a year, ten hours a day, as is customary in farm work, reduces a unit of work to the cost of four cents. A petroleum engine is considerably more economical, but in France this work costs seven cents on account of duties. A windmill produces a unit of work at two cents, but a water wheel, the cost of whose installation is $160 per horsepower, can produce the unit of work as a constant quantity as low as one cent. It is readily seen, therefore, how a community backed by an economical and up-to-date water power can maintain its commercial existence as against another community in the same business, the members of which furnish their own labor, or employ beasts of burden, or run steam engines. Power is a component part of the cost of anything which is made. Every article, therefore, in daily use, which is a manufactured article, is the product of power and material, and the item of power in it is a factor of more or less extent. In calcium carbide, for instance, which has a general use, power makes up sixty per cent. of the cost of the product; and, therefore, a carbide factory, or a similar industry, should be located next to a water power in order to thrive. Ordinary flour from which bread is made can be produced at a rate of four barrels a day for each horsepower employed in the work; and the principal cost of making flour is grinding the wheat. Therefore, if power is cheapened by the introduction of a natural water power, bread foods are cheapened in consequence, and in the case of the flour mills at Seattle, for example, this item of cost has been cut in two since the advent of power from Snoqualmie Falls. If an article is cheapened by virtue of cheapening the cost of power, or by cheapening any other component part which goes to make up the cost of the article, then more of that article will be used, and a broader market for it will be obtained, more people will find employment in its manufacture and a larger and more prosperous community will result. Power, therefore, in its cheapest form, which must of necessity be from falling water, is the underlying force which will give health, vigor, strength and prosperity to an industrial community. Of two manufacturing communities, manufacturing the same article and for the same market, if one is able to secure an advantage over the other of only a few per cent., either in the item of power, or in the raw product, then the community which possesses this advantage will drive the other to some other line of business.

On Puget Sound, accessible by ocean commerce to the world's markets, where the differential obtained by the use of falling water as a power agency is from twenty to fifty per cent., is it not reasonable to predict an industrial growth in consequence thereof, which will make the cities affected by it sovereigns among those of the manufacturing world? Will not more people enjoy the luxury of electric illumination in their homes in consequence thereof, where several lights are available for the price which formerly prevailed for one light? Electric light is power, light being simply a different manifestation of power. As the cost of light is made up principally of the cost of power, and incidentally of the cost of selling and distributing it, cheaper power therefore establishes a price on such a luxury which will make it possible of enjoyment by a wider range of people. It is power also which propels street cars and interurban trains, transporting people from one place to another in a convenient fashion. Power is the principal item entering into the cost of serving this transportation, and if this factor of cost is lessened it then becomes possible to carry more people in comfort for less money.

A city, therefore, which offers these utilities upon a more plentiful and cheaper scale than do other cities, would naturally gather to itself an ever increasing population. Observe what Niagara has done for Buffalo and other places to which the natural power of that great cataract has been made tributary. Manufacturing and industrial establishments have broadened the scope of their operations, and concerns from other parts of the world have been attracted there. This has increased the wealth of the section benefited by bringing the theretofore waste power of Niagara into the markets of the world in the shape of manufactured products and bringing back the gold of the world in exchange therefor. Increased employment has been furnished for labor, and the population of the cities has been increased and new centers of population and wealth have been established thereby. This is an object lesson which applies as well under the shadow of Snoqualmie Falls, or wherever inexpensive and practical water power exists, as at Buffalo.

A manufactured article is the product of material and power. If the mass is great the motion is small, and if the mass is small the motion or speed is great. There are myriads of small manufactured articles where the raw material is insignificant, but where the machine work

WAYMAN GOODWIN, CATCHER DRENDELL LEVY

or power is considerable; and, therefore, the largest factor in making up the cost of the finished product. On the contrary, where the mass or material is great, the power is generally small. All these give employment to the natural power and the skilled mechanic. The raw material is made into salable form and finds a market throughout the world, and the gold of other States and countries, where it finds its market, comes into the manufacturing community in return for the article sent out, and thus wealth accumulates. Industrial communities are always thrifty; the people are happy and contented, unless labor agitators intrude; they are constantly growing in wealth, contentment and independence, and the saving banks have nearly as many deposit accounts as there are workers in the community. Thus it is that the ingenuity of man has contrived to enable him to keep a hand upon the throttle of one of Nature's most powerful forces, to use it as he wills, and so to multiply many fold his share of the world's work.

BASE BALL DE LUXE.

SPERRY was at the bat, on that eventful afternoon of Saturday, August 5th, when the Electrical Contractors and the Electrical Jobbers, both of San Francisco, were each struggling to uphold for themselves, by fair means or foul, the glory of a conquest on a diamond field. Drendell, in well trained brawn, shot the sphere in deft simulation of the boomerang thrower, but precisely over the home plate, nevertheless.

"Ball, one!" ejaculated Umpire Bibbins, safely shielded behind the catcher's screen fence.

Then Drendell delivered another liner just where it was wanted.

"Ball, two!" mumbled Bibbins, and "Hully gee, Drendell, don't pitch em so swift," complained Sperry in unison with the umpire.

Amid a wail of discontent from some at this decision, mingled with cries of derision from others at the batsman's timidity, the pitcher "went to it" again in perfect precision as before; Sperry dodged needlessly for the third time and the umpire called out from the security of his wire cage:

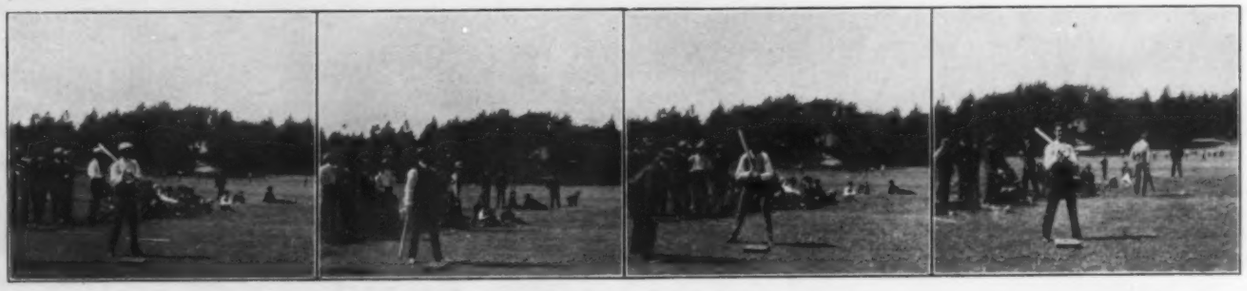
"Three balls; take your base."

Off prances Sperry gaily to first base, merry in the delusion that Drendell's pitching was the worst ever and that it only required the nerve of an umpire like Bibbins to turn him down for it. But that's no josh!

And so the game went on in one jolly after another, the Contractors matching their hard muscles and earnest playing against the "diplomatic" brains and ever incessant raillery of the Jobbers. As to the game itself, its merits are beyond comment—quite out of reach of any rational or serious consideration, as it were. Undoubtedly the Contractors played better ball, such as it was; they were in better shape to do it, and as for the Jobbers' players, Goodwin was the good one but Wayman was good too. Perhaps it is best to omit comparisons between the merits of the respective players, however, because the reader would fail to distinguish between arrant flattery from positive libel.

According to pre-arrangements, the gamesters met for lunch at a down town cafe, after which an Ellis Street car was boarded (Martland paid the freight) for the recreation grounds at Golden Gate Park. The day was fair enough, considering the time of year and the fact that it was in San Francisco—there was but little wind, less fog and, in consequence, the sun actually shone most of the time. A favorable field was secured, a little preliminary practice was indulged in, the Contractors took the first inning, Bibbins and Pennoyer were agreed upon as umpires, and the game was on.

Let the score, which is here presented, speak for itself, and in listening to it, for the sake of the proprieties of the game, heed not what it says too closely lest you learn that, as the game advanced, so advanced the best batsman of each side (and especially of the Contractors' side) to the bat regardless of batting numbers or of put-outs. In fact, toward the last of the game, some fellows on both sides never went to the bat at all, and other fellows who were good batsmen but poor runners would bat the ball and make their bases by subsidizing professional sprinters to run for them. Oh, it was a great game in that it grated like the base brawl that it simulated. Then the list of casualties was also of the same. Hall has a middle finger the knuckle of which he proudly exhibits for being twice its normal size, Parsons for a week held his righ elbow in his left palm when shaking hands, Fowden says his hip is a study in dull chromatics of various hues ranging from black and blue to bilious green garnished with red about the edges and, in brief for a week all the Jobbers were in various conditions of physical desetude, except Goodwin who's tough anyhow—despite the fact that as a rule none of the Jobbers were able



SPERRY JOHN R. COLE PARSONS MARTLAND

to play more than a single consecutive inning without asking for a substitute.

But the grand play occurred during the last half of the ninth inning when the score stood twenty-one to ten in favor of the Contractors and when the Jobbers, true to their name, did twelve runs in as many minutes. But in the meantime sundry of the Contractors, wearying of being jobbed, had left the field. Willing Jobbers took their places, however, and on went the game until victory had been earned. If they had been fifty behind they would have won, for Vampire Bibbins was with them and that was enough.

CONTRACTORS

	1	2	3	4	5	6	7	8	9	
Schreiner, c	1	1	1	0	0	1	0	0	0	—4
Conway, p	1	1	0	0	1	0	0	1	0	—4
Owen, 1b	0	0	0	0	0	0	0	1	0	—1
Drendell, 2b	1	0	0	1	0	0	1	0	1	—4
Levy, 3b	0	0	0	1	0	0	0	0	0	—1
Richmond, ss	1	0	0	1	0	1	0	0	0	—3
Yerrington, Crary, lf	1	0	0	0	0	1	0	0	0	—2
Horn, Stewart, cf	0	0	0	0	0	1	0	0	0	—1
Martland, rf	0	0	1	0	0	0	0	0	0	—1
Runs	5	2	2	3	1	4	1	2	1	—21

JOBBERS

	1	2	3	4	5	6	7	8	9	
Goodwin, Fowden, c	1	0	0	0	1	0	0	0	3	—5
Goad, Bray, Nieze, p	0	0	1	1	0	0	0	1	1	—4
Chester, Drury, Fowden, 1b	0	0	0	0	0	1	0	0	1	—2
J. R. Cole, Hall, 2b	0	0	1	0	0	0	0	1	0	—2
J. Drury, Thaxter, 3b	0	0	0	0	0	0	0	0	2	—2
Wayman, ss	0	0	1	0	0	0	0	1	3	—5
Bauer, Russell, lf	0	0	0	0	0	0	0	0	1	—1
G. A Cole, Parsons, cf	0	0	0	0	0	0	0	0	1	—1
Harris, Sperry, rf	0	0	0	0	0	0	0	0	0	—0
Runs	1	0	3	1	1	1	0	3	12	—22

THE BUSINESS OF THE GAS ASSOCIATION.

ASIDE from the reading of papers and their discussions, considerable business of importance was transacted during the thirteenth annual meeting of the Pacific Coast Gas Association, held in San Francisco on July 18, 19, 20th last. Of especial importance was the determination to hold the annual meeting beginning on the third Tuesday in September of each year, instead of in July as heretofore; and the appointment of a committee on permanent headquarters for the association.

The following officers were elected to serve during the ensuing year: President, John Martin, San Francisco; vice-president, C. O. G. Miller, San Francisco; secretary and treasurer, John A Britton, San Francisco; directors, C. R. Collins, Seattle; R. H. Sterling, Watsonville; W. F. Boardman, San Francisco; Herbert C. Brown, Los Angeles.

Before adjournment, President Martin announced the appointment of the following:

Advisory Braid, E. C. Jones, C. O. G. Miller, John A. Britton.

Editor of the Wrinkle Department, Geo. S. Colquhoun.

Editor of the Experience Department, R. P. Valentine.

Editor of the Novelty Department, Geo. H. Hollidge.

Committee on Gas Engineers' Degree, L. P. Lowe, E. C. Jones, John A. Britton.

Committee on Permanant Home, L. P. Lowe, C. O. G. Miller, Henry C. Keyer.

Historian, Geo. P. Low.

During the session new members were elected as follows:

REGULAR MEMBERS.

Wm. Durbrow, Manager, Oroville Light and Power Company, Oroville, Cal.

Joseph A. Moore, Assistant Superintendent Risdon Iron Works, San Francisco, Cal.

A. J. Burrows, Superintendent Grays Harbor Gas Company, Aberdeen, Wash.

W. M. Kapus, Sales Manager, Portland Gas Company, Portland, Or.

Geo. A Campbell, Constructing Engineer, California Light and Fuel Company, San Francisco, Cal.

Clarence E. Breckenridge, Assistant Gas Department, California Gas and Electric Corporation, San Francisco, Cal.

Albert J. Weber, President, Corporation of Adam Weber Sons, New York.

John M. Gardner, President, Monterey County Gas and Electric Company, Monterey, Cal.

Charles C. Moore, President Charles C. Moore and Company, Engineers, San Francisco, Cal.

H. J. Edwards, Manager United Gas and Electric Company, San Jose, Cal.

Edward Stratton Jones, Gas Apprentice, San Francisco, Cal.

L. J. de Sabla, Purchasing Agent, California Gas and Electric Corporation, San Francisco, Cal.

Wm. M. Glass, Superintendent Gas Department, Prescott Electric Company, Prescott, Ariz.

W. R. Castle, President, Honolulu Gas Company, Honolulu, H. I.

E. F. Oswald, Manager, Palo Alto Gas Company, Palo, Alto, Cal.

A. N. Campbell, Treasurer, Honolulu Gas Company, Honolulu, H. I.

Walter M. Brown, Engineer, Honolulu Gas Company, Honolulu, H. I.

Lucius S. Biglow, President, Light Publishing Company, N. Y.

Wallace H. Foster, Manager, San Rafael Gas and Electric Company, San Rafael, Cal.

Clarence Cope, Constructor, Gas Department, California Gas and Electric Corporation, San Francisco, Cal.

E. C. Lufkin, Manager, Snow Steam Pump Works, Buffalo, N. Y.

Wm. D. Halket, Proprietor, Bay City Iron Works, San Francisco, Cal.

C. N. Scott, Chief Engineer, Gas Engine Department, Snow Steam Pump Works, Buffalo, N. Y.

Benj. F. Thomas, San Luis Gas and Electric Company, San Luis Obispo, Cal.

Edward A. Rix, President, Rix Compressed Air and Drill Company, San Francisco, Cal.

T. H. Creden, Vice-President and General Manager, San Diego Gas and Electric Light Company, San Diego, Cal.

H. A. Potter, Manufacturing Agent, Gas Stoves, 52 First Street San Francisco, Cal.

E. L. Hall, Chemist, San Francisco, Gas and Electric Company, San Francisco, Cal.

E. S. Dougherty, Superintendent, Reno Power, Light and Water Company, Reno, Nev.

U. M. Slater, Vice-President, Reno Power, Light and Water Company, Reno, Nev.

P. L. Flanagan, President, Reno Power, Light and Water Company, Reno, Nev.

A. E. Hurst, Superintendent, Selma Light and Water Company, Selma, Cal.

C. S. Reber, Superintendent, Butte Gas Light and Fuel Company, Butte City, Mont.

D. W. Campbell, Superintendent and Manager Riverside Light and Fuel Company, Riverside, Cal.

C. H. Hunt, With San Francisco Gas and Electric Company, San Francisco, Cal.

J. Jerome Smith, President, Lodi Natural Gas Company, Stockton, Cal.

F. F. Minaker, Gas Arc Agent, 530 Market Street, San Francisco, Cal.

Ira C. Carter, Superintendent, Pomona and Ontario Light and Fuel Company, Pomona, Cal.

J. A. Keys, President, Suisun, Natural Gas Company, Suisun, Cal.

C. M. Grow, General Manager, San Bernardino Gas and Electric Company, San Bernardino, Cal.

ASSOCIATE MEMBERS.

Whatcom County Railway and Light Company, Bellingham, Wash.

The Michigan Stove Company, 256-262 South Clinton Street, Chicago, Ill.

Light Publishing Company, Inc., 265 Broadway, New York.

Frank H. Brown, Superintendent and Treasurer, Davis-Farnum Manufacturing Company, Waltham, Mass.

H. Mueller, Manufacturing Company, Decatur, Ill.

Charles C. Moore & Co., Engineers, 63 First Street, San Francisco, Cal.

Honolulu Gas Company, Honolulu, H. I.

D. F. Brown, Manager, Gas Stove Department, Rathbone, Sard and Company, Albany, N. Y.

California Light and Fuel Company, 576, Parrott Building, San Francisco, Cal.

Chas. F. Terhune, Vice-President, Wm. M. Crane Co., N. Y.

Bartlett, Hayward and Company, Manufacturings Gas Works Apparatus, Baltimore, Md.

Patrick Goodman, Manufacture of Gas Main Stoppers, 1668 Park Avenue, New York.

Equitable Meter Company, 445 Water Street, Pittsburg, Pa.

John Gribbel, John J. Griffin & Co., Philadelphia, Pa.

Humphrey Company, Kalamazoo, Mich.

John C. English, Pacific Coast Manager, The Enos Company, San Francisco.

James B. Clow & Sons, Chicago, Ill.

United Coke and Gas Company, 17 Battery Place, New York.

Phoenix Light and Fuel Company, Phoenix, Ariz.

S. R. Dresser, Manufacturer Couplings, Clamps Company, Bradford, Pa.

Watsonville Light and Power Company, Rialto, Building San Francisco, Cal.

Monterey County Gas and Electric Company, Monterey, Cal.

John Dell, President and General Manager, Missouri Fire Brick Company St. Louis, Mo.

Storrs Mica Company, Manufacturer Mica Chimneys, Oswego, N. Y.

Holophane Glass Company, 127 Fulton Street, New York, N. Y.

Grays Harbor Gas Company, Abardeen, Wash.

Geo. Light, Manufacturer, Tapping Machines, Dayton, O.

Town of Santa Clara, Santa Clara, Cal.

John E. Gaitley, President, Albany Poundry Co., Albany, N. Y.

Long Beach Gas Company, Long Beach, Cal.

Valley Gas and Fuel Company, Pasadena, Cal.

Palo Alto Gas Company, Palo Alto, Cal.

R. D. Wood & Co., San Francisco, Cal.

Modesto Gas Company, Modesto, Cal.

Thos. Day & Co., San Francisco, Cal.

Western Fuel Company, San Francisco, Cal.

Associated Oil Company, San Francisco, Cal.

Consolidated Heat, Light and Power Company, Visalia, Cal.

Riverside Light and Fuel Company, Riverside, Cal.

Pomona and Ontario Light and Fuel Company, Pomona.

Whittier Light and Fuel Company, Whittier, Cal.

The annual banquet was held at Demonico's on the evening of July 19th, there being present the goodly number of members shown in the accompanying group.

AFTER THE BANQUET FOLLOWING THE THIRTEENTH ANNUAL MEETING OF THE PACIFIC COAST GAS ASSOCIATION

The Journal of ELECTRICITY, POWER and GAS
DEVOTED TO THE CONVERSION, TRANSMISSION and DISTRIBUTION OF ENERGY.

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VOLUME XV SEPTEMBER, 1905 NUMBER 9

EDITORIAL.

WHITHER ARE WE GOING?

Before essaying to answer this question, let it first be asked: "Who's 'we'?" And for reply, "we" may be the people, the great American public resident on Pacific shores, and "we" may be, as we are, a certain and by no means inconsequential factor of the community aforesaid, namely, its engineering talent. It is sought to know, then, whither engineering development during the next decade or so is likely to lead industrial development on this far western shore. That it will lead somewhere goes without saying, for there is no one but knows that the times are not stationary. Again—whither?

The far-reaching, far-seeing and ever-active penchant of capital for domination tells clearly of that which will transpire in the industrial world that has to do with the generation, transmission and distribution of power: the spirit of corporate consolidation is to continue to grow and wax fat—aye, even unto monstrosity—and then, something else with which our progeny may labor. Modern commercialism finds but sickly sympathy in its heart toward the commercial rivalries of our daddies and the aphorism that "competition is the life of trade" is as but a nursery rhyme to the industrial magnate of to-day. And, gentlemen of the corporate fry, lest you forget, be admonished that, sooner or later, it will be your turn to be both swallowed and assimilated through the maw of some insatiable "octopus." Then prepare yourselves and make of yourselves most dainty and appetizing morsels, that your devourers may crave you the more and, in craving, pay well for the epicurean delectation your carcass will give.

Way up in far corners of certain counties of California, as occurs elsewhere each fall in various localities throughout the West during the slender crescent of a new moon, the Indians gather together for "the big cry," when they bewail their dead and burn quantities of clothing and foodstuffs that might far better be administering to their own needs. Then, a week later, comes "the big eat," when neighboring tribes visit in a doubtfully-delectable feast of acorn gruel and boiled dog without horseradish sauce. After everything "from soup to nuts" has been devoured, the festivities end—sometimes a long-drawn-out end—in an earnest game of hokey-pokey, wherein one tribe gambles its all against the other, even to horses and huts and hags.

Modern commercialism is now in "the big cry" stage, for it wails over the burdens of dead pioneering investments as piteously as it does begrudgingly offer up possible profits in sacrifice to the inexorable laws of competition. But by and by, when dead accounts are squared and competition is no more, the "tribes" will come together in "the big eat," and in the orgies that follow one particular set of braves will become possessed of all the belongings of the others.

To be among "the others" is the destination of the many, so far as corporate interests are concerned.

In the meantime territorial development and industrial evolution are going on ceaselessly, hand in hand. Engineering practices are becoming standardized, and as such civilization is accepting them without let, even for the cornerstone of its industrial structure. Turn to the stock markets and there one finds gas and electric securities taking rank with those of transcontinental railway companies and financial and insurance institutions; indeed, lighting and electric railway stocks and bonds, as a class, are typical of those of all quasi-public corporations, and there is a growing conviction that some day, perhaps in this generation, a wave of united opinion will sweep these semi-public enterprises into the hands of the people. When that day comes, the people will be the survivors of "the big eat."

But now expansion and development are the watchwords: existing systems are to branch out into which ever directions will show reasonable indications of present or prospective earning capacities, and undeveloped resources are to be made productive whenever and however possible. Natural barriers to progress are being broken down, and even the autocracy of the land baron, whose sway has contributed more to retard the settlement of great inland domains than probably any other single cause, is being assailed with an earnestness foretelling its downfall.

An old farmer stood on the vestibule of the last car of a Southern Pacific train running over the Willows branch, as it pulled out of Dunnigan one day last spring.

"All of these towns along this road are just as they were twenty years ago;" said he, "they haven't grown a bit."

"That's surprising and I can't understand it, when prosperity and development are on every hand," rejoined a fellow-traveler.

"Nothing surprising about it," he replied. "The towns can't grow while the ranches are so big. This is all one ranch"—with a sweep of the arm.

A glance sufficed. On every side was the vast field of golden grain that, billowing in the sun and bordered by a horizon of silver-tipped mountains in the purple distance, furnished a picture as glorious as that of the sunset clouds enclosing the sea. Then came concurrence in the knowledge which the old farmer implied that the thorough subdivision of these vast empires can alone forerun the enormous population which the country will sustain. In reality, this situation applies to practically all grain-growing and stock-raising sections of California.

That this generation, or mayhap the next one, will devise means for accomodating the population that is its birthright is one of the many things that is to be, and gas and electric transmission lines, and the interurban electric railway line, are to be more instrumental in bringing about the new condition than any other trio of forces.

Of these three forces, the greatest, in a direct sense, is the railway, for it is the quickest of any agency to discover locations eligible to population and to develop their resources through the powerful influence of perfect transportation service. It is deft in searching out resources that have long if not always been dormant, it infuses life into sleepy communities and it makes farms of wastes, towns of ruralities, and cities of towns. On every hand are these "fit subjects" for development. The city of Colusa, for instance, may be cited as a case in point. Colusa, accessible to open navigation in the Sacramento River all the year round, but which is at best not very expeditiously reached by the Southern Pacific plus ten miles of narrow gauge road that tires, is 140 miles north of San Francisco. It has probably 2000 inhabitants, its age is venerable for California, it is a county seat and is in the center of one of the most important grain-growing sections of Northern California. It is reasonably prosperous, but slow; its fame is largely due to the brains of the late Will S. Green, who, as editor of the *Colusa Sun*, voiced the sentiments of the country folk before the State with eloquence, and its curse is the mighty landed interests already referred to. To emancipate Colusa requires the subdivision of the rancherian empires surrounding it, and the giving of it such transportation facilities as only an electric railway system can extend.

There are scores of similar localities on every hand in California. Witness the marvelous perfections of the suburban electric railway in Southern California, where it links each important community with practically every other by ties so strong that steam railways are fast realizing that they will soon find no place in local traffic if existing conditions are to prevail. Witness the innumerable new electric railway projects throughout other sections of the State—the Yosemite lines, the system of the Northern Electric Company which, initially, will connect Chico and Oroville; the Marysville-Nevada City line which will traverse a virgin country, the resources of which will contribute to both the Southern Pacific and the Western Pacific railroads; the Colusa-Benicia line with its proposed branch roads tapping Woodland, Madison and Capay; the Marysville-Colusa line which will eventually reach Oroville; the Yolo line, to connect Woodland with Davisville, Winters, Madison and Knight's Landing, with others of equal if not greater importance.

Then, in Oregon, for instance, note the recent project to build an electric system of extraordinary import. Press reports state that two hundred miles of standard-gauge electric lines in the form of a big loop, with Portland as the starting point and terminus, is the latest electric railway project of capitalists who have just returned from a survey of the right of way which leads into the St. Helens mining district of Washington. The projected road starts from Portland, proceeds to Vancouver, crossing the Columbia River via Woodlawn, follows the north bank of the Columbia to Ridgefield, Woodland, Caples, Kalama, Kelso, Ladu, to Stella, thence to Castle Rock, Silver Lake and the St. Helens mining district, a branch through to the Morton coal fields, and a line through the mining district which shall cover all of the important mineral deposits of that section, thence in a southerly direction toward the mineral ground north of Washougal, down to the Columbia River, and through Washougal, Camas, Fishers and Vancouver, back to Portland. Power for the road is to be obtained from a plant which will be located on the Toutle River, where engineers have estimated 35,000 horsepower can be generated from the fall of the river. Other plants are to be constructed, and the electrical power thus obtained will be used to operate the road and for commercial purposes.

Beyond this, the organization of a system to link the whole Willamette Valley into a single chain of electric railways is assured, and a new line is now under construction from Portland to Hillsboro and Forest Grove. Eastern Oregon, Washington and Idaho are being gridironed with electric railway projects—in brief, the woods are full of them everywhere.

Then, some time in the future, consolidations will be effected, as stated, for all industrial evolution is leading up to it. And when that day comes, the trade will find itself as a group of Martian satellites about the planet Jupiter.

That's one thing more that we are coming to.

FAR WESTERN DEVELOPMENT.

In a recent issue of a most valuable eastern contemperary* there appears an editorial reference to the engineering development of the Far West, which is well worthy of reproduction as reflecting the Eastern sentiment regarding Western enterprise. It reads:

Such articles as that which appears in our present issue, relative to the electrical development in the vicinity of Portland, bring

Electrical World and Engineer Volume XLVI, page 166, July 29, 1905.

again forcible to mind how large and generous a field for electrical exploitation that Far West and the Pacific Slope have been. The work around Portland is on a large scale and of great importance and interest, and it is evident that Oregon is a splendid territory for electric light, power and transportation. In like manner, California has already shown its leadership and originality in hydro-electric development, while the same state is virtually at the head of the list in the utilization of the telephone by the public. If the Californian ratios prevailed all over the country, the United States would be much farther advanced electrically than it now is. In electric mining the advances have been extraordinary, and yet it would seem that only a beginning has been made, from which the brightest future may be anticipated.

ADVERTISING ENGINEERS.

PRODUCTS of scientific manufacture require promotion even more than do commercial articles of general consumption. The engineer or manufacturer who has spent years of work and thought upon the perfection of a new product or machine accepts as axiomatic that, because there is a need for it, there will be a demand. He forgets that before his possible customers will give up their accustomed and familiar methods to adopt the new, they must to some degree pass over the same mental course that he has traversed, and, unless educational measures are adopted, this is apt to be a matter of many years. To introduce his improvements in steam engine valve gears, Corliss was forced practically to giving his machines away. The Parsons steam turbine was an engineering success ten or twelve years before it became a commercial success in this country. On the other hand, the turbine centrifugal pump, by modern advertising methods, has been made commercially successful in a period of two years, the sales of the third year being four times those of the first, while a prominent cordage manufacturer has increased the sales of his transmission rope twenty times over within a few years by means of advertising.

Not only, however, do engineering products require an educational publicity campaign for their introduction within reasonable time, but all the methods of general advertising, suitably modified are in some way applicable in promoting their sale. There is a science of economy of communication and apprehension, as of other things, and some ways of overcoming paychological inerta are less expensive and attended with less friction than others.

Recognizing these facts, some engineering and manufacturing concerns have established advertising departments and have placed them in charge of men of high ability. This plan, however, is more expensive than most businesses justifiy and many firms attempt to handle the work through already overburdened executive officers or else turn it over to clerks.

To meet these conditions, Halbert P. Gillette and Geo. H. Gibson, formerly manager of publicity for the International Steam Pump Company, manager of the advertising department of the B. F. Sturtevant Company and editor of the Westinghouse Companies' Publishing Department, have formed a partnership as "advertising engineers," under the name of the Geo. H. Gibson Company, with offices in the Park Row Building, New York City. They undertake to conduct a firm's advertising in the same manner as would a department in the firm's own offices, and are not advertising agents in the usual sense of the term, as they receive no commissions, rendering only service and leaving the actual purchasing of space and printed matter in the client's hands.

PERSONAL.

Mr. William A. Doble, president of the Abner Doble Company, San Francisco, has gone East on business.

Mr. J. W. Marsh, general manager of the Standard Underground Cable Company, of Pittsburg, Pa., visited San Francisco during the middle of August.

Mr. B. F. Kierulff, Jr., of Los Angeles, has been in San Francisco several days establishing offices here. He left for the Portland Fair on September 1st.

Mr. William Knight, formerly with the General Electric Company, of San Francisco, and also with the Brooks-Follis Company, is now with B. F. Kierulff, Jr., & Co., of Los Angeles.

Mr. J. L. Lambirth, whose professional card appears on an advertising page of this issue under the name of the Sunset Electric and Engineering Company, (Incorporated) of Portland, Or., was for several years general superintendent and purchasing agent of the Salem Light and Traction Company, of Salem, Or., as well as supervising engineer for the construction of a number of electric light and power plants in the Pacific northwest.

Mr. Charles H. Harris has been transferred from The Seattle Electric Company to the Minneapolis General Electric Company, where he will take charge of additions which are being made to the underground and distributing systems of that plant.. Mr. Harris has been closely identified with the construction of the underground system which has recently been installed throughout the business portion of Seattle by The Seattle Electric Company. Mr. Harris was recently married to Miss Eleanor A. Condon, of Seattle.

Mr. Louis H. Bean severed his connection with The Seattle Electric Company, on August 1st to take the management of the Whatcom County Railway and Light Company, of Bellingham. Mr. Bean has been connected with The Seattle Electric Company for several years in various capacities. For the past two years he has held the position of superintendent of wires, having charge of all lighting and power and railway lines, both overhead and underground. At Bellingham he succeeds Mr. F. E. Frothingham, who has returned to Boston to renew his expert work at the home office of Messrs. Stone & Webster. The Whatcom County Railway and Light Company operates about fourteen and one-half miles of street car lines in and around Bellingham, furnishes light and power, and also conducts a gas business in that city.

Mr. Frank A. Ross, whose rare qualifications of geniality and business ability have made him popular in every walk, has resigned from the general managership of the Sacramento Electric, Gas and Railway Company to accept a like position with the Northern Electric Company, which is to construct an extensive electric railway lighting and power system in northern California, its principal feature as at present planned, being an electric railway between Chico and Oroville. It is significant of Mr. Ross' popularity when such an independent and critical newspaper as is the Sacramento *Bee*, will devote more than a column of its leading editorial (of July 26th) to an eulogy of a street railway official, yet it does so in Mr. Ross' case saying, among many other complementary things:

> Frank A. Ross rose from the ranks. He is a sterling example of the fact that a laborer little by little advanced to be a manager can still retain a human heart for those on the lower rungs of Life's ladder, and in helping them along can at the same time do yeoman work to advance the business of his employers.

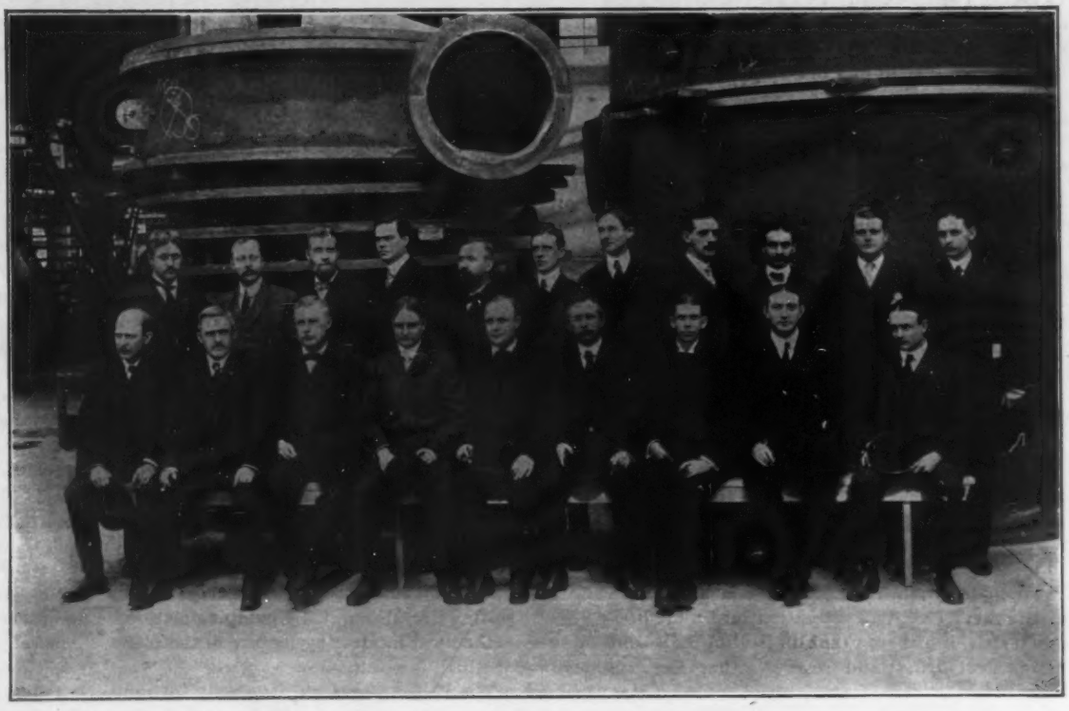
GEO. P. LOW.

Mr. Geo. P. Low, who has for a number of years been associated with THE JOURNAL as editor, has resigned the editorial chair. Mr. Low will hereafter devote himself to the specialization of descriptive write-ups of engineering machinery, processes, plants and properties.

Mr. Low has been for many years familiar with electrical matters on the Pacific Coast, and the excellent descriptive articles which have appeared from time to time in THE JOURNAL bear evidence to his fitness for the new field of enterprise in which he proposes to embark. His technical experience has been such as to enable him to quickly grasp the salient features of new projects and enterprises and to treat them both from the engineering and business sides.

Mr. Low has a host of friends in engineering circles on the coast who will join THE JOURNAL in wishing him all success in his venture.

INDUSTRIAL



The accompanying cut shows the sales managers assembled in the Worthington machine shop. The names from left to right in the front row are: C. B. Moore, Boston; Henry Laidlaw, Detroit; D. A. Acer, Buffalo; W. R. Reeves, St. Louis; J. J. Brown, manager of Worthington sales; F. H. Jones, general sales manager; A. W. Jones, Atlanta; Reuben Bowen, marine department; Fred Ray, centrifugal department. In the upper row beginning at the left, Geo. H. Gibson, manager of publicity; G. P. de Laval, manager of works; G. J. Foran, condenser department; J. B. McGuire; Geo. W. Galbraith, Cincinnati; Thos. C. McBride, Philadelphia; Lincoln Crocker, Cleveland; Chas. E. Wilson, Chicago; C. A. Hamilton, Pittsburg; E. S. Barlow, New York; H. F. Peake, meter department.

The advantages of meetings of this kind is giving greater unity and intelligent co-ordination to the making and selling of engineering products are rapidly being recognized and they are especially important where the apparatus is of many specialized types, often requiring the exercise of expert knowledge for its efficient adaption to the customer's needs.

WILLAMETTE IRON AND STEEL WORKS FORGE TO FRONT.

THE Willamette Iron and Steel Works, of this city, have filed supplementary articles of incorporation authorizing an increase in their capital stock from $125,000 to $300,000, and coincidently with this increase are making extensive improvements and additions to their plant, which is already the largest engineering establishment in the State of Oregon.

For some time past it has been rumored that the rapid growth of this institution would shortly necessitate a change of location, and the management has had under consideration a number of available waterfront sites where there would be ample room for future extensions. Prior to taking such a radical step, it was thought advisable to bring the present plant up to a higher state of efficiency in order to get the full benefits from the natural advantages offered by a location so favorable to general repair and manufacturing opportunities.

Pursuant with this policy, the present blacksmith shop will be converted into an additional space for machine tools, a much larger and more convenient forging department being built to occupy 50 x 75 feet on the northwest corner of the property. The foundry will be extended to meet this new blacksmith shop, thus devoting one continuous space 200 feet long to these departments. The foundry equipment will be greatly improved by the addition of a ten-ton all-electric crane, which is now installed at the Lewis and Clark Exposition. The present erecting shop will also be greatly enlarged and a number of the most modern machine tools will be added to the machine-shop equipment. These additions will utilize to the best advantage all the available space of the block and will greatly increase the producing power of the plant.

The shipping facilities by rail are unsurpassed, the cars of all four trans-continental railroads being available by private spur, and the river-front location of the allied industry, the Willamette Boiler Works, makes the handling of marine work most convenient and economical.

Ample warehouse and office requirements are provided by the substantial brick building which occupies the corner diagonally opposite the works, and in all respects the Willamette Iron and Steel Works may be considered admirably fitted to take care of the increasing machinery requirements of the country.

The policy has been to eliminate a large amount of promiscuous manufacturing and to devote the entire facilities of the plant to the development of a few specialties. The recent progress in offsetting Eastern competition has been a great encouragement to the hope that the increasing importance of the maritime development of Portland will shortly warrant the installation of a

thoroughly modern plant, where steel ship building and other extensive engineering undertakings may be handled in a way which will bring Portland into prominence as a port which is not only able to produce its own ships, but able to give the same quick dispatch to important repair work that has been one of the most salient features in accenting the prominence of some of the other cities on the Pacific Coast. In fact, the drydock—which is equal to any similar dock in the world—can only be brought up to any real state of efficiency by being operated in conjunction with the complete equipment of a modern engineering establishment.—*Portland Oregonian.*

REMOVED TO NEW QUARTERS.

THE California Engineering and Construction Company, whose office at present is at 104 Rialto Building and works at 63 and 65 Minna Street, will move about September 15th to their new quarters 625 to 633 Howard Street, opposite New Montgomery Street. The new location, recently vacated by the Mutual Electric Company, being 75 feet wide by 165 feet deep will afford them ample room for their rapidly increasing business. The office will be situated on the Mezzanine floor with a commodious show room below it. The shop which will occupy a space of 75 feet by 125 feet, will be fitted up with modern machinery, cranes and other labor saving devices.

B. F. Kicrulff, Jr., & Co., will open an office at 519 Mission Street under the charge of George B. Ellison, formerly with the Western Electric Company, Chicago. They will represent the Waclark Wire Company, wires and cables; F. Bissell Company, electric and telephone supplies, switchboards; W. R. Gorton Company, railway material; National Telephone and Supply Company, Tripartite Steel Pole Company, Central Union Brass Company, line materials, bearings; Franklin Rolling Mill and Foundry Company, steel poles; and several other Eastern manufacturers.

IRRIGATION WORK IN KALEIA, KAUAI, H. T.

AN interesting application of water wheels, as applied to irrigation work, is afforded at the pumping plant of the Makee Sugar Company, of Kaleia, Kauai, H. T. This company controls a large acreage which has heretofore been barren, owing to the fact of its being situated above the irrigation canals on which the land is dependent for water during the greater part of the year.

The principal irrigation canal on the island, carrying a large volume of water, is situated on the other side of a mountain from the ground to be irrigated, and at a considerably lower elevation.

There is ample water below this land, but it was unavailable for lack of means to elevate it to the required height. The problem was solved by the application of hydro-electric transmission, using the water from the large canal on one side of the mountain to develop power which is applied electrically to pumps on the other side, thus elevating water to a sufficient height to irrigate the barren land. We have, then, a condition wherein the water of one watershed is the means of irrigating the lands of another.

The water in the main canal is an extremely variable quantity, not only from one season to another, but at different hours of the day; consequently, any transmission scheme must provide means for running the pumps at highest efficiency, taking into account the fluctuations in the initial power due to varying water supply. It is obvious that to accomplish this it is necessary to vary the speed of the electrically driven pumps almost in direct proportion to the varying power of the water wheels. This is accomplished by synchronous motors, which, by varying the cycles according to the speed of the generator, are enabled to vary their power output and speed in the same proportion. This, of course, involves a corresponding change of water wheel speed according to the water available, the wheels to run faster during periods of greater water supply, and slower as this diminishes.

In order to reduce the operating expense to a minimum, an operator is in attendance at the generating station only, the resulting operations at the pumping station being automatic. This is the most interesting feature of the plant, a general description of which is given below.

The Pelton water wheels are six in number, of different diameters, and each fitted with buckets designed for the special conditions of wheel speed and water supply involved, the static head being 390 feet. Each wheel is of such diameter and power capacity as to run the generator at the proper speed to correspond with the pump output, this being maintained at a maximum in accordance with the water used by the wheel. These six Pelton wheels are

HAWAIIAN PUMPING STATION EQUIPPED WITH PELTON WHEELS

all mounted on the same shaft, and arranged to run in the same wheel compartment, one at a time, the unit being direct-connected to a single electric generator of 500kilowatts capacity. Thus the largest diameter wheel is to drive the generator at 280 revolutions per minute and use five cubic feet of water per second, and the smallest at 450 revolutions per minute, using eight cubic feet of water per second, the intermediate wheels running at intermediate speeds and using proportionate water quantities. Each wheel is supplied with a single stream of water through a nozzle of proper diameter, and the streams are controlled independently by a hydraulic gate operated through a special three-way valve. If the supply of water is falling off, as indicated to the station operator by gauges, he closes the valve of the operating wheel and opens that of the next slower wheel and vice versa. These changes may occur several times a day, but it is always possible to deliver irrigating water to the higher levels in direct proportion to the supply water, thus obtaining a maximum daily efficiency and insuring the highest returns on the investment.

The variation in water wheel efficiency will be extremely slight if working at intermediate speeds between those for which the wheels are specifically calculated. The use of hydraulic gates for controlling the flow of water to each wheel, makes the accomplishment extremely simple, and in addition to this method of control there is provided a stream cut-off on each nozzle operated from a common rock shaft. This, in turn, is controlled by a special device arranged to hold at any speed between 450 and 280, depending on the position at which the connecting belt may be set on the cone pulleys. The electric power is transmitted over the mountain to the pumping station where synchronous motors are direct connected to Reidler pumps working against a head of 250 feet. The electrical and pumping machinery was furnished by the Allis-Chalmers Company, and the complete hydraulic equipment by the Pelton Water Wheel Company, of San Francisco.

CURTIS STEAM TURBINES IN JAPAN.

CHARACTERISTIC of the present progressiveness of Japan is the fact that outside of Europe and the United States this small Nation is the longest user of steam turbines in the world. With the industrial awakening of the Island Empire has come a need for electric power not only for manufacturing purposes, but for transportation and for lighting. Japanese engineers are wide awake, and their enterprise is nowhere more clearly indicated than in their adoption of steam turbine electric generating units, which in other parts of the world are so rapidly replacing the old style reciprocating engines in the electrical field.

On July 29, 1904, the first shipment of steam turbines arrived in Japan via the Steamship "Korea" from San Francisco. They were of 500 kilowatts capacity, of the Curtis type, and were for operating the Shigai Railway in Tokio. Four weeks from their arrival they were in full operation. As significant of the success of these first units, there have been ordered by the Japanese from the General Electric Company, of New York, thirty-seven Curtis steam turbines with a total normal capacity of more than 35,000 horsepower. Of these, eleven units are now installed and in satisfactory operation.

Japan is not slow in adopting the electrical systems which will improve her manufacturing and transportation facilities and give her people better lighting service. They are using electricity for operating the street railways of their cities and for indoor and street lighting. In the use of electric power for machine shops, they are following only the best American practice, which, as a rule requires electric motors mounted on each tool. The coal mines of Japan will eventually be operated electrically. Some of the turbines mentioned above are intended for the Miike Coal Mines on the Island of Kyushu. These are owned by Mitsui and Company and will use two 1000-kilowatt Curtis steam turbines.

The Osaka Electric Light Company furnishes electricity to the City of Osaka, which has a population of over 800,000, and its plant is equipped entirely with American electrical apparatus, including six steam turbines of the same make. The capital of this company is 2,400,000 yen, and with its progressive methods it will soon rival some of our modern American illuminating companies.

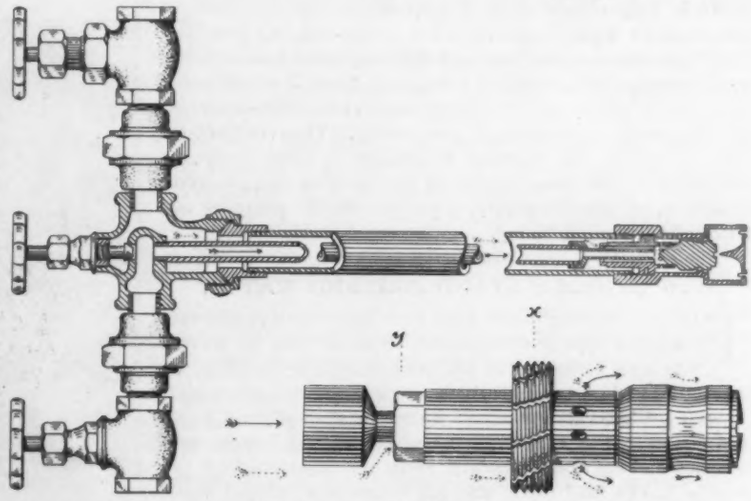
One of the largest electrical interests in Japan that has ordered some of the machinery referred to above is the Tokio Street Railway Company. This company, the Japanese name of which is Tokio Shigai Tedsudo, furnishes transportation facilities for the City of Tokio, which has a population of 1,440,000. Its franchise runs until 1952. Apparently the municipal ownership idea has obtained some weight in Japan, for this franchise provides that after the year 1932 the municipality may purchase the property of the company by paying a proper price for it. Its capital stock is 15,000,000 yen, divided into 300,000 shares. Although some English and German material is being used by this road, practically all the electrical equipment is American made. This includes five 2000 horsepower Curtis tubro-generator units with power house equipment and railway motors furnished by the General Electric Company, as well as Wheeler condensers and Brill trucks.

WITT'S "LITTLE GIANT BURNER NO. 2."

THE G. E. Witt Company, engineers and machinists of 530 Mission Street, San Francisco, has placed upon the market a new oil burner known as "Little Giant No. 2" which promises such remarkable advantage as to enable it to be handled like a gas jet. This burner, the delails of which are shown in the accompanying drawing, has a double tip which can be either forced to a high degree or reduced as may be desired. By way of further explanation it is only necessary to state that the tip is divided into two parts to cause an equal amount of oil to issue from each slot, and that the steam entering around the oil pipe at the tip is introduced for the purpose of keeping the tip clean.

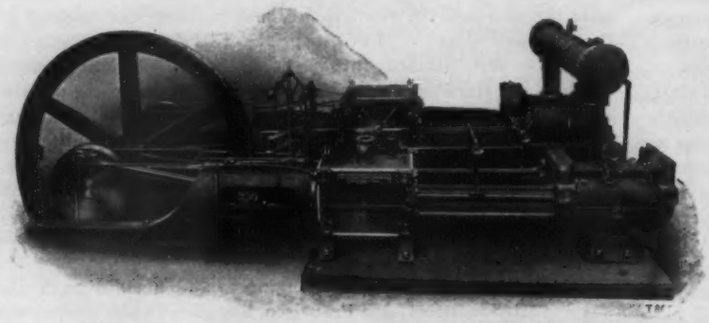
WATER SUPPLY BY COMPRESSED AIR.

THE water supply of Los Angeles, Cal., has in the past been received by gravity, only a few higher parts of the city being supplied by pumping into the mains. The growth of the city, however, has made an aditional supply necessary,



and a pumping plant is to be installed in the southwestern part of the city, near Slauson Junction, where wells have been bored to water-bearing strata lying sixty to 200 feet below the surface. As these wells are too deep to permit of their operation by pumping engines located on the surface, and as it would be commer-

cially impracticable to pump them by deep-well pumps with long plunger rods, and, again, very costly to excavate pumping stations underground near the water level, it has been decided to operate them with compressed air, which offers the further advantages of aerating and cooling the water and permitting one central plant to operate all the wells scattered over a half-mile stretch. The system adopted is the air-lift, in which compressed air is forced through one pipe down to the bottom of the well, where it discharges under the mouth of another pipe reaching to the top of the well and emptying into the reservoir. The bubbles of air issuing from the first pipe enter the mouth of the second, but do not fill it completely, as a large amount of water is carried in between the bubbles. For this reason the weight of water within the second pipe is less than that in an equal cross-section



THE TWO-STAGE USED IN THE LOS ANGELES AIR-LIFT WATER PUMPING STATION

of the well exterior to the pipe. The pressure of the water in the well, therefore, is greater and forces the mixture of air and water in the pipe to rise constantly, and, as the bubbles of air are constantly supplied at the bottom, this process goes on without intermission, the mixture of air and water discharging at the top of the well in a practically constant stream. The air, as it rises toward the top, expands, thereby returning the work which was expended in its compression, and, as in expansion the temperature of air is greatly reduced, it serves at the same time to cool the water.

In the present case the twelve wells will discharge into a common reservoir, from which the water will be forced by a pumping engine into the city water mains. The water in the wells at present stands about sixty feet below the surface, but, as has been found in irrigation work in California, the ground level of subterranean water supplies is apt to be lowered considerably by continuous pumping, and the compressor has therefore been designed to pump, if necessary, from a much lower level, being guaranteed to deliver 2000 cubic feet of air per minute against a pressure of 100 pounds. The contract for the compressor was awarded to the Baker Iron Works, of Los Angeles, the local agents of the Laidlaw-Dunn-Gordon Company, of New York City, manufacturers of pumping and air compressing machinery.

HOW DYNAMOS STAND FIRE AND WATER.

THREE Westinghouse sixty-two and one-half-kilowatt engine type generators which have been in service in the basement of the New England Building, in Cleveland, Ohio, have recently been subjected to a test which shows up Westinghouse construction in a very good light. A fire occurred in the basement where the generators were installed and completely burned away the insulation on the outside of the field coils; the fire department played upon these machines with six lines of hose for one hour. Within one hour from the time the water was turned off the machines one of them was in operation and carrying its full rated load. The second machine was put in operation later, and carried its full rated load, and at the present time two of these machines are operating under the load normally carried by all three of them.

The fire-proof insulation of the field coils withstood the fire perfectly even through the outer protecting coverings were entirely consumed, and the heat was so intense as to burn and blister the finish on the frames. Electrical machinery as usually constructed is scarcely expected to stand a fire and water test, but it appears that such a guarantee might have been made on these generators.

ALLIS-CHALMERS' REMARKABLE EXTENSION.

THE Allis-Chalmers Company has decided to begin immediately a three-million-dollar extension to its Milwaukee works for the manufacture of electrical machinery of all kinds of the largest types, and for the construction of steam turbines, hydraulic turbines and gas engines. Three large buildings will be erected, two of the existing buildings will be extended, and the electrical department at Milwaukee will be operated in connection with the plant of the Bullock Electric Manufacturing Company, of Cincinnati, which is owned by the Allis-Chalmers Company.

These unique facilities will provide what will undoubtedly be one of the largest engineering manufacturing establishments in the world, and the first to concentrate under one organization the design and construction of steam electric units, turbine and reciprocating, on a large scale, as well as hydraulic electric units.

The importance of this, in connection with the immense development of electrical engineering which is everywhere taking place, is regarded as a matter of unusual interest.

STANDARD UNDERGROUND CABLES AT PORTLAND.

DURING the recent Engineering Congress at Portland, the Standard Underground Cable Company was very much in evidence among the Transmission Association attendants through its two representatives, A. B. Saurman, manager of the Pacific Coast sales department, and J. E. Hoar, of the Portland office, both of whom made many new and lasting friends in both social and business ways.

The exhibit made by the company in the Machinery and Electricity Building of the Lewis and Clark Exposition created favorable comment by reason of the superb quality of the goods displayed. Though it is unpretentious, it contains complete lines of exhibits of bare and insulated copper wires and cables for tele-

THE STANDARD UNDERGROUND CABLE COMPANY'S EXHIBIT AT THE PORTLAND FAIR

phone, telegraph and electric light and power services in both underground, aerial and interior varieties. The exhibit constitutes in part that which was made at the St. Louis Fair.

THE FILLING OF A RUSH LAMP ORDER.

THE extraordinary facilities possessed by the California Electrical Works for prompt deliveries of any class or quantity of electrical goods on short notice was enlarged upon in the article which recently appeared in these columns* in description of its establishment. The facilities were put to the test a few days since when about eleven o'clock in the morning a cablegram was received from an electric supply company in Manila, Phillipine Islands, asking for the shipment of 5000 variously colored incandescent electric lamps by the steamer which sailed on the day following at noon. It so happened that the lamps required were not in stock, which compelled the California Electrical Works to purchase clear lamps from an outside concern. These lamps had to be unpacked, the labels taken off, a drying and testing rack erected, the lamps colored and then relabeled, after which they were wrapped in tissue paper, then in heavy paper and finally packed for export. The work involved necessitated the handling of each lamp seven times, or a total of 35,000 times for the shipment; a task which required the services of twelve men working continuously from eleven o'clock of the morning stated until eight o'clock the next morning in order to prepare the order for shipment by the steamer sailing at twelve o'clock.

STATEMENT OF THE CHICAGO PNEUMATIC TOOL COMPANY.

THE officers of the Chicago Pneumatic Tool Company have presented to its stockholders a statement of its earnings for the half year ending June 30, 1905, as follows:

STATEMENT OF PROFITS.

Profits for the half year		$413,941.54
Less—Depreciation of buildings, plant and machinery, including repairs and renewals of buildings and plant	$52,705.02	
Less—Written off for experimenting and perfecting new lines of tools	4,800.00	57,705.02
		$356,236.52
Less—Bond interest for the half year	$57,500.00	
Less—Sinking fund reserve	25,000.00	82,500.00
Profit available for dividend		$273,736.52
Less—Quarterly dividend No. 9 1 per cent	$61,137.83	
Quarterly dividend No. 10 1 per cent.	61,137.83	122,275.66
Balance carried to surplus		$151,460.86

SURPLUS ACCOUNT.

Surplus brought from 1904	$254,030.82	
Less—Appropriation on account of development work and written off	28,593.51	$225,437.31
Surplus for the half year ending June 30, 1905		151,460.86
Surplus carried forward		$376,898.17

TRADE CATALOGUES.

"Small Motors" is the title of Bulletin No. 60, of the Crocker-Wheeler Company, describing small I. C. motors for every purpose.

"Catenary Line Construction" as installed by the Westinghouse Electric and Manufacturing Company for heavy interurban traffic, is described in its circular No. 1110.

"Automatic Railway Block Signals" as furnished by the General Electric Company are beautifully detailed and described in publication No. 9138 of the company named.

*THE JOURNAL Volume XV, page 242, June, 1905.

"Lundell Universal Motors" are described fully in Bulletin No. 400 of the National Electric Company. They are of the direct current type, of pleasing designs and are evidently well built and most serviceable.

"1500-10,000-volt Fues Devices" is the third and last of the invaluable bulletins issued by the H. W. Johns-Manville Company. Its purport and scope has been detailed in reference to the similar bulletin described below.

"Westinghouse at the Lewis and Clark Exposition" is a brouchure which makes the Portland Fair the occasion of briefly reviewing practically the entire list of products of the Westinghouse Electric and Manufacturing Company.

"600-Volt Devices" is the title of the second of three catalogues issued by the H. W. Johns-Manville Company of 100 William Street, New York, with a branch office at 127 New Montgomery Street, San Francisco, the other two catalogues being devoted to 250-volt and 1500 to 10,000-volt devices respectively. The series undoubtedly presents the most comprehensive work of the kind ever published, as they describe minutely each and every kind of the well known "Noark" enclosed fuse and fuse device that is manufactured.

"The Morgan Continuous Gas Producer" is the title of a valuable catalogue issued by the Morgan Construction Company, engineers, founders and machinists, of Worchester, Mass., giving much instructive information regarding the rapidly developing industry of producer gas manufacture. All who are interested in this most modern means of securing the highest heating value of fuel will appreciate the remarkable tests made by Robt. W. Hunt & Co., on the producers at the plant of the Grand Crossing Track Company, showing an average efficiency of 92 per cent. This record speaks well for the progress that has been made in perfecting a continuous automatic producer. Views are shown of large installations. Exceptional interest centers in the elaborate analytical description given of the details of the Morgan continuous gas producer process, which is exemplary in its fullness, but the catalogue contains much other invaluable information of a general trend. Information on the subject of gas for power purposes is, however, reserved for a later publication of similar nature.

FINANCIAL.

CLOVERDALE, CAL.—On July 24th the people of Cloverdale voted favorably upon water and sewer bonds to the amount of $30,000.

REDDING, CAL.—William Ellery of San Francisco has purchased at trustee's sale all the property and machinery of the bankrupt McCloud River Power Company.

RENO, NEV.—It is stated that the Brown-Engenger Syndicate has purchased the Reno Power, Light and Water Company and will take possession on August 1st.

SANTA ANA, CAL.—W. R. Todd & Co., bankers, of Cincinnatti, Ohio, have bought the local electric lighting bonds, voted more than a year ago, to the extent of $57,000.

CLOVERDALE, CAL.—On July 25th the people of this city voted to incur a bonded indebtedness of $30,000, $12,000 of which is in water works' bonds and 18,000 being in sewer bonds.

GILROY, CAL.—This city has decided to issue $51,000 in bonds as follows: Sewers, $25,000; water works, $15,000; electric lighting system, $11,000, and completing City Hall $5,000.

CITY OF MEXICO, MEX.—The Mexican Electric Lighting Company is being formed for the purpose of absorbing the Mexican Gas and Electric Light Company and the San Ildefonso Company.

LOS ANGELES, CAL.—The San Joaquin, Light and Power Company has filed a certificate of bonded indebtedness in the sum of $3,000,000, secured by 5 per cent. bonds in denominations of $1000 each.

TONOPAH, NEV.—The Nevada Power and Milling Company, of which T. J. Campbell is president, C. M. Hobbs, general manager and George M. Romer, superintendent, has acquired the plant and business of the Tonopah Light and Power Company.

PROVO, UTAH—On July 11th the people of Provo, voted for the issue of $91,000 for the completion of the water works system extension to the present intake, and the purchase of the Provo Electric Company's distributing plant and the erection of an electric power plant to supply the electricity for lighting the city.

SAN FRANCISCO, CAL.—A certificate of the diminution of the capital stock of the California Electric Light Company, signed by Chas. Sutro, president, and J. E. Green, seeretary, has been filed in the county clerk's office. The capital stock which was $5,000,000, has been reduced to $500. The company has $68,-557.15 in the treasury and no other assets.

PORTLAND, OR.—The Clackamas Power Company has been organized by J. T. Apperson, H. E. Cross, C. H. Dye, E. G. Caufield and Irwin B. Sanborn. The object of the new company is to erect and maintain dams on the Clackamas River and to develop its power, and to buy and sell real estate, to operate a logging industry, etc. The capital stock is $25,000, divided into 100 shares at $250 per share.

EUGENE, OR.—An eastern syndicate which owns electric plants at Spokane, Walla Walla, Baker City, Pendleton and Salem, have completed a deal through his agent, A. Welch, of Salem, for the purchase of the plant of the Lane County Electric Company, at Springfield, which furnishes light for that town and Eugene. The syndicate will take control of the plant in October, the local company continuing to operate it until then.

SEATTLE, WASH.—The Seattle Electric Company reports earnings for the twelve months ending May 31, 1905, and 1904 respectively as follows:

Gross earnings	$2,378,040	$2,213,898
Operating expenses	1,632,848	1,548;917
Net earnings	745,192	664,981
Interest charge	301,416	274,068
Net profit	443,776	391,913

YREKA, CAL.—The Siskiyou Electric Power Company has absorbed the Yreka Electric Lighting plant, formerly owned by E. T. Osburne, who becomes vice-president of the Siskiyou company. This deal is important, as it takes over the last and largest of six local electric companies which have been added to the system of the Siskiyou Electric Power Company, and gives the company the entire field in Siskiyou County, where it is distributing power and light over ninety miles of territory.

WATSONVILLE, CAL.—The California Gas and Electric Corporation has filed a deed to the gas plant, mains, poles and an assignment of the franchise and the electric light and power lines of the Watsonville Light and Power Company, which had been made over to them last year, back to the Watsonville corporation, which has placed on record a mortgage securing the Mercantile Trust Company, of San Francisco, for guaranteeing the issue of $200,000 worth of fifty-one-year bonds, bearing interest at the rate of 5 per cent. per annum.

PORTLAND, OR.—The Sandy River Electric Company was incorporated on July 26th by E. B. Coldwell, C. W. Pallett and F. V Cobb with a capital stock of $10,000, The company's purpose is to hold water rights and surveys acquired by C. W. Miller and others on the Sandy River from the mouth of Bull Run to the Base Line Bridge. The incorporation is a part of a plan entered on more than a year ago to develop water power in the Sandy River. It is said that within the limits described a 200-foot fall will be secured a short distance above the Base Line Bridge which will generate 16,000 horsepower.

MARYSVILLE, CAL.—The stockholders of the Marysville and Nevada Power and Water Company have elected the following directors to serve during the ensuing year: James O'Brien of Smartsville, W. W. Waggoner and W. F. Engelbright, of Nevada City, and J. E. Ebert and Lon H. Mitchell, of Marysville. They organized by electing W. W. Waggoner, president; Lon Mitchell, first vice-president; W. F. Englebright, second vice-president; Jas. O'Brien superintendent; James K. O'Brien, treasurer; J. E. Ebert, secretary and attorney; W. W. Waggoner, chief engineer; and W. F. Englebright, consulting engineer.

PORTLAND, OR.—The Portland General Electric Company has placed on record a mortgage given to the United States Mortgage and Trust Company, of New York, on its entire plant, for $10,000,000. The company has just sold $4,000,000 in bonds to N. W. Harris & Co., the proceeds of which will be used in extensions. At the annual meeting of its stockholders, held in July, the following officers were elected: H. W. Goode, president; Samuel G. Reed, secretary, and J. C. Ainsworth, A. C. Bedford C. H. Canfield, Sylvester Farrell, Frederick V. Holman, W. M. Ladd, F. B. Pratt, W. K. Smith and F. G. Sykes, directors.

MARYSVILLE, CAL.—On July 20th the stockholders of the Marysville Power and Water Company elected the following directors to serve during the ensuing year: W. W. Waggoner and W. F. Engelbright, of Nevada City, James O'Brien, of Smartsville, J. E. Ebert and Lon H. Mitchell, of Marysville, and James K. O'Brien and W. A. O'Brien of Smartsville. The directors immediately organized by electing Waggoner, president; Mitchell, first vice-president; Engelbright, second vice-president; James O'Brien, superintendent; Elbert, secretary and attorney; James K. O'Brien, treasurer, Waggoner chief engineer and Engelbright consulting engineer. The company owns valuable power and water rights at the Narrows in the Yuba River and is preparing to build a great dam there to raise the water to the level of a ditch that will carry 100,000 inches of water northwest to the point where the power station will be located. From there it will be carried toward Honcut and used for irrigation purposes.

LOS ANGELES, CAL.—From local reports which are credited it appears that The Edison Electric Company has acquired the systems of the Redlands Gas Company, the Riverside Light and Fuel Company, the Pomona and Ontario Light and Fuel Company and the Whittier Light and Fuel Company, paying for the last two properties approximately $500,000, the buyers assuming bonded indebtedness of about half the sum, and paying the remainder for the stock of the three companies, each plant representing about one-third of the entire valuation. The Edison Company already owns gas plants in Santa Barbara, Long Beach, Ocean Park, Santa Monica, San Pedro and Santa Ana. It has light and power plants at Pomona and Whittier, where its officers now become possessed of the gas plants, and it is engaged in the lighting and power business at Redlands, from which there is said to be a possibility that it will extend power lines to Riverside. The list of cities in which the Edison Company operates electric, but not gas, plants includes Los Angeles, Pasadena, Redlands, Orange, Fullerton, Redondo and Monrovia.

SAN FRANCISCO, CAL.—The Nevada Power, Light and Water Company has $1,000,000 capital stock and $750,000 bonds, $300,-000 of which are reserved for the purpose of retiring a like amount of the Nevada Power, Light and Water Company 6 per cent. bonds. The 6 per cent. sinking fund bonds now offered are issued to acquire a controlling interest in the Washoe Power and Development Company and the Nevada Transit Company. There are no bonds against either of these two companies and none can be issued in the future. The Reno Power, Light and Water Company owns the water works supplying the cities of Reno and Sparks (combined population (15,000), water power plant, electric light plant, gas plant, ice plant and cold storage plant, all of which supply the two cities named. Of the properties to be acquired the Washoe Development Company owns a power plant located on the Truckee River, the only available power site left within a radius of 250 miles. The Nevada Transit Company connects the two cities of Reno and Sparks, which are about four miles distant. The Washoe Company is acquired on a basis of

$225,000, and the Nevada Company on a basis of $100,000. The proceeds of the bonds offered by Christensen and Company will be used entirely in payment of the stock of these two companies. An estimate of the value of the Reno Power, Light and Water Company properties before acquiring the two companies named is $806,424 against which $512,000 bonds are issued. This value does not include water rights and franchises. The earnings of the company for the year ended March 31, 1905, were as follows:

Gross	$156,597
Operating expenses	61,653
Net earnings	94,943
Total interest charge on $512,000 (being amount outstanding during said period)	30,720

It is expected that the acquisition of the two companies named will increase the net earnings of the company at least $40,000 per annum, making total net earnings of about $135,000 against which the interest charge on the entire $750,000 bonds will be $45,000.

TRANSMISSION.

EUREKA, CAL.—The North Mountain Power Company began the distribution of power from its transmission lines into Eureka on July 1st.

SPOKANE, WASH.—The Washington Power Company is to extend its transmission lines to Colfax, a distance of one hundred miles south of here.

HAINES, OR.—The Hyland Mine is to install an electric power transmission plant for its exclusive use, the power for operating to be obtained from Rock Creek.

BOISE, IDA.—M. E. Hopkins, of the American Exploration Company, is authority for the statement that a power transmission plant is to be installed for the Nellie Mine.

BAKER CITY, OR.—The Baker Light and Power Company is surveying the route for a power transmission line which is to be built from the site of its new power house on Rock Creek, over the ridge into Bourne and along the various mines on Cracker Creek.

CITY OF MEXICO, MEX.—The Los Jeronimos water fall which is situated in the Pedrenas Valley in the state of Guerrero and has a height of 120 meters has been acquired by a Belgian Company for $300,000 gold for the purpose of developing power for electrical transmission purposes.

SAN FRANCISCO, CAL.—The Stanislaus Light and Power Company has begun work on the new plant which it is to build at Wilson's flat on the Stanislaus River four miles from Murphys. A head of 1700 feet will be available from twelve miles of ditching, and it is claimed that the minimun flow of 17,000 miners inches may be relied upon.

SUMPTER, OR.—Seymore H. Bell, general manager of the Mountain Home Electric Company, has secured a thirty year franchise for electric service in Mountain Home, Idaho, with the understanding that the plant shall be completed within ninety days. It is stated that it is the intention of the company to install a $30,000 plant.

OLYMPIA, WASH.—Henceforth the power and electric lights used in the State Penitentiary are to be obtained from the transmission lines of the Northwest Gas and Electric Company, of Walla Walla, which will effect a saving of from 25 to 35 per cent. in the cost of operation in addition to avoiding a six weeks shut down of the jute mill each year for repairs.

ESCONDIDO, CAL.—Local business men are endeavoring to secure electric light and power service for Escondido, to accomplish which it has been suggested that a power plant could be installed to be driven by water which is taken from the city reservoir under a head of 400 feet, or that a steam power plant could be erected or that power could be transmitted thither from Oceanside.

CITY OF MEXICO, MEX.—W. H. Mears, Mexican representative of The Platt Iron Works Company, Dayton, Ohio, reports the organization of a new electric light and power company at Allende to which he sold Victor turbines and electrical machinery for a complete power plant. The company referred to consists of Pedro Gonzalez, J. Gonzalez, Jose Angel Garza, Ponciano Romo W. C. Cadena.

ASHLAND, OR.—The Condor Water and Power Company has begun excavation on the site of a power plant on the Rogue River, which is to be one of the largest enterprises of the kind in the state. This site, from which a minimum of 25,000 horsepower is available, is at the falls of the Rogue River forty-five miles above Gold Ray where the river plunges more than 500 feet in about 800 feet, and a tributary stream at the same point drops over a sheer precipice of 250 feet. The canal being excavated will not divert the entire stream, but will give all the energy that will be required in southern Oregon for many years. The manager does not indicate when the work is to be finished, but says that construction will be steady until it is completed.

ASHLAND, OR.—The Gold Ray plant of the Condor Water and Power Company, and which is located on the Rogue River near Gold Ray, Jackson County, has been completed to a capacity of 3200 horsepower. This plant supplies electric service to Metford, Ashland and the intermediate country, while its northern line has reached the Greenback Mine, forty-five miles from the generating station, and the southern extension is in Ashland. Contracts have been made with the city of Ashland, and it is not likely that the southern line will be extended beyond that point for the present. In supplying the mines, contracts have been made with the Greenback for 300 horsepower, and it is probable that this amount will be increased later. The Granite Hill will immediately put its entire plant on electricity. At the Champlin dredge two carloads of machinery have arrived to put all machinery there on the new energy, the contract with the Gold Ray people being 230 horsepower. The Opp is using electricity, and it is likely that the Oregon Belle will do so for compressor and mill.

SEATTLE, WASH.—The Seattle Electric Company is this fall to install an additional 2000-kilowatt step down transformer at its Massachusetts Street substation. This will make a total capacity of 10,000 kilowatts available for the reception of power from their Puyallup plant. Hitherto this power has been transformed from 50,000 volts three-phase to 2300 volts two-phase at this station, and transmitted to Post Street station, their main generating station, and through it to other substations for distribution. After the installation of the new transformer three of these step down transformers will be used to step down to 13,000 volts three phase for transmission direct to Fremont and James Street substations. Thus Post Street will be relieved of all power but that which is directly distributed from that station. There will be installed at James Street four 1000-kilowatt air blast transformers to step down from 13,200 volts three-phase to 2300 volts two-phase, and at Fremont two similar 500-kilowatt transformers. Each station is to be supplied with duplicate blower sets, each of which is capable of cooling the entire bank of transformers. These transformers will furnish current for the railway motor generator sets and the single phase lighting circuits at these substations. The capacity of the Fremont substation for railway power is to be increased by the addition to the present equipment of two 300 kilowatt motor generator sets of a 500-kilowatt synchronous motor generator set. The motor of this set is to be wound for the full line voltage(13,200 volts.) The field excitation of this motor is to be controlled by a T. A. regulator so connected as to keep a constant voltage on the 2300-volt busses by varying the power factor of the load drawn over the transmission line. This, it is expected, will give a satisfactory lighting and railway service from the same busbars. The transmission line from Massachusetts Street to James Street is of No. 4-0 stranded bare copper, and that from James Street to Fremont of No. 0 solid bare copper. These lines are supported on six inch (Locke No. 3 3-4) insulators with wood pins.

TRANSPORTATION.

SALINAS, CAL.—F. M. Hilby has been awarded a local electric railway franchise.

LAS VEGAS, N. M.—The Las Vegas Street Railway Company announces that it will at once expend $100,000 on extensions.

STOCKTON, CAL.—It is announced that the Southern Pacific Company has acquired the property of the Stockton Electric Railway system.

STOCKTON, CAL.—C. A. Harp, of this city, is securing rights of way for the electric railway to be built from Sacramento to Stockton and Antioch.

OGDEN, UTAH,—The directors of the Ogden Rapid Transit Company have been authorized to expend $40,000 in improvements and extensions.

SEATTLE, WASH.—The Mineral City Power and Transportation Company capitalized at $1,000,000 has been incorporated by W. J. McAllister, O. O. Rowen and Chas. M. Baxter.

PALO ALTO, CAL.—A party of engineers is surveying a right of way through Stanford University for an electric road which is to connect the electric lines of San Mateo and San Jose.

STOCKTON, CAL.—The Western Construction Company capitalized at $250,000 has been incorporated by J. C. Girder, Geo. A. Brown, Jr., and others, particularly to build a new street railway system in this city.

ALBUQUERQUE, N. M.—The Union Gas and Traction Company, capatalized at $500,000, by C. H. Pattison and N. D. Pattison, of Kansas City, Mo., W. L. Pattison, Gardner, Kas., and J. F. Luthy, of Albuquerque, N. M.

SAN JUAN, CAL.—An ordinance has been passed granting to J. C. Kemp Van Ee, of San Francisco, an electric railway franchise covering certain streets of this town, as well as the county road between Chittenden and Hollister.

PORTLAND, OR.—Construction work on the Metropolitan section of the new electric railroad of the Oregon Traction Company to connect Portland with Hillsboro is being actively prosecuted by the Atlas Construction Company, of which B. E. Hooper is superintendent.

SAN DIEGO, CAL.—Work is being actively prosecuted on the electric street railway which E. S. Babcock will build on C and Sixth streets, connecting the depots of the Pacific Beach and La Jolla road, the National City and Otay road and the Cuyamaca and Eastern road.

SAN BERNARDINO, CAL.—The Board of Directors of San Bernardino Valley Traction Company have instructed A. C. Denman, Jr., its general manager, to extend the company's lines from Colton to Riverside with a double track and to tear up that part of the line between San Bernardino and Redlands and build via a shorter route. $700,000 will be expended.

LOS ANGELES, CAL.—H. E. Huntington has purchased the entire holding and interests of the Los Angeles and Redondo Railway Company. The property comes into the hands of Mr. Huntington through his purchase of every share of the capital stock of $1,000,000 and the assumption of the bonded indebtedness of $500,000. Many improvements will be made.

SAN FRANCISCO, CAL.—The United Railroads has made application to the Board of Supervisors for permission to lay an underground conduit on Mission Street from East to Ninth streets for the purpose of laying its feed wire, which carries the current to operate the Mission Street electric lines. The conduits will be of vitrified clay and will be constructed close to its tracks.

SAN DIEGO, CAL.—The San Diego Electric Railway Company will construct a double track on the Logan Heights line south easterly to National Avenue and Twenty-sixth Street, preparatory to inaugurating a two minute service. The Fifth and University avenues lines will be double tracked beyond the St. Joseph's Sanitarium. A line will also be constructed through Middletown, from D Street, northerly out State Street.

EL PASO, TEX.—It is stated that it is the purpose of the Jalisco Rapid Transit Railroad Company to build a transcontinental electric railway for the transportation of passengers and freight from a Pacific Coast point through the State of Jalisco, Mexico, across Mexico to a seaport on the Gulf of Mexico. The company has secured a concession therefor from the Government and the first section will extend from Guadalajara to Chamela.

PORTLAND, OR.—Charles E. Loss, of San Francisco, has been awarded the contract for constructing the line of the Lewiston and Southeastern Electric Railway between Grangeville and Lewiston, with a branch line to Nez Perce. The contract carries with it plans for the building of a large power plant. It is estimated the line will cost approximately $3,000,000, and every effort is to be put forth to complete the project by June 1, 1907.

SAN FRANCISCO, CAL.—The Central California Traction Company, capitalized at $2,500,000, has been incorporated by Mortimer Fleishhacker, Alden Anderson, H. H. Griffiths, et al. At the outset the company is to build twelve miles of electric road within the city limits of Stockton and a line fifteen miles long between Stockton and Lodi. Later on lines are to be constructed to Sacramento, Modesto and other points. The system will embrace 200 miles of road.

HILLSBORO, OR.—The construction company that is to execute the contract for building the first ten miles of the Portland Nehalem and Tillamook Railroad has established a big camp of carpenters and pile drivers nearby. Lumber for the bridges is being delivered as rapidly as it can be prepared at the mills, and considerable has already been delivered for culverts and cattle guards. The right of way has been cleared for several miles, and the entire ten-mile stretch is cleared. Grading is in progress within the city limits, and other crews will be at work in a few days. There is a crew of engineers at present engaged extending the survey beyond Buxton and into the divide.

WATER WORKS.

SAN RAFAEL, CAL.—The Marin County Water Company is to expend $150,000 in building a dam at Phoenix Gulch, together with a large pumping plant and water mains.

SANTA ANA, CAL.—The Newport Beach Water Company has been incorporated with a capital stock of $100,000 by J. H. Sharp, May J. Sharp, R. McFadden, E. M. Smiley and T. B. Fischer as directors.

TONOPAH, NEV.—Senator T. L. Oddie, and Eastern capitalists are negotiating for the piping of water from the Oddie Ranch sixty miles northeast of here to this city and Goldfield. It is stated that the work will cost about $1,000,000.

OAKLAND, CAL.—E. B. Halladay, attorney for the Western Water and Electric Company, has notified the Board of Public Works that he will shortly make a proposition to furnish the city with water from the North Fork of the American River, the water being diverted therefrom at Euchre Bar, Placer County, where it is claimed that a continual flow of 15,000,000 gallons daily is available.

ANAHEIM, CAL.—Clem A. Copeland, the mechanical and electrical engineer, of Los Angeles, has submitted a report to the City Council upon the cost of enlargements and improvements of the municipal water and electric lighting systems, finding the total cost to be $40,000. Among his recommendations is the erection of a 200,000-gallon steel tank. According to his report, enlargement of the electric system would cost $8000; of the water works, $5000; new building, $3700; new engine, $9500; tanks, $8000. The total gross price of the work is found to be $41,500, but $1500 is allowed for old machinery which would be displaced by the new works. A bond election thereon will be called.